Oelwein Municipal Airport

Pavement Management Report

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OELWEIN MUNICIPAL AIRPORT
PAVEMENT MANAGEMENT REPORT

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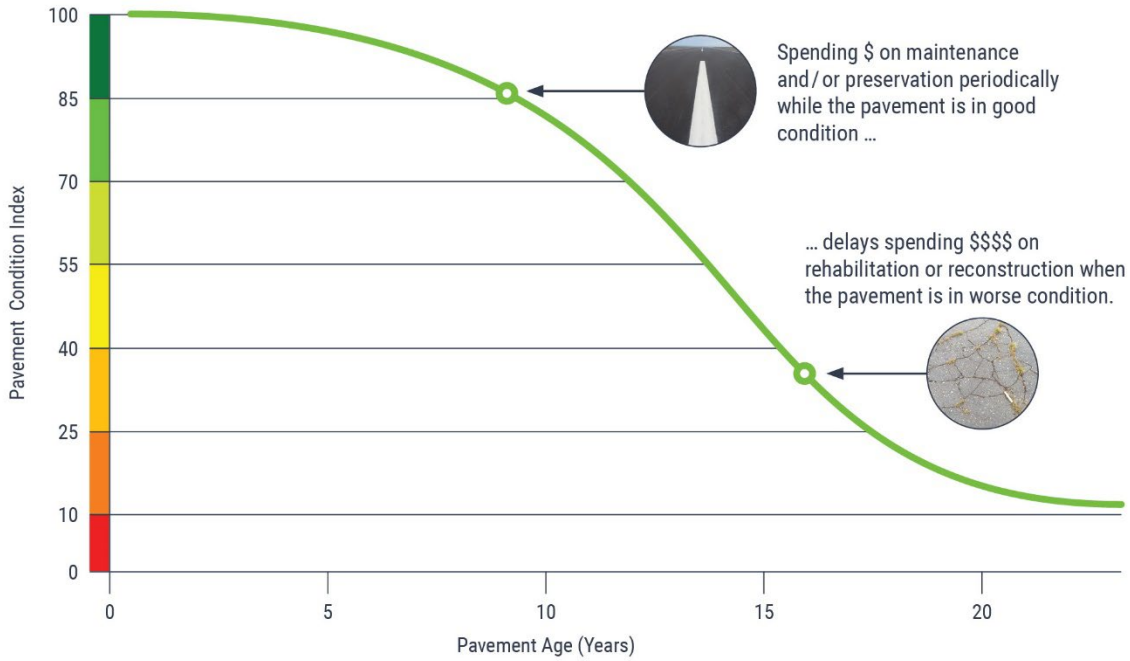
INTRODUCTION

Applied Pavement Technology, Inc. (APTech), with assistance from Robinson Engineering Company Consulting Engineers (Robinson), updated the Airport Pavement Management System (APMS) for the Iowa Department of Transportation, Modal Transportation Bureau (Iowa DOT). The APMS provides a means to monitor the condition of the pavements within the state of Iowa and to proactively plan for their preservation.

As part of this project, pavement conditions at Oelwein Municipal Airport were assessed in November 2022 using the Pavement Condition Index (PCI) procedure. During a PCI inspection, the types, severities, and amounts of distress present in a pavement are quantified. This information is then used to develop a composite index that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). The PCI provides an overall measure of condition and an indication of the level of work that will be required to maintain or repair a pavement. The distress information also provides insight into what is causing the pavement to deteriorate, which is the first step in selecting the appropriate repair action to correct the problem.

Programmed into an APMS, PCI information is used to determine when preventive maintenance actions (such as crack or joint sealing) are advisable and to identify the most cost-effective time to perform major rehabilitation (such as an overlay or whitetopping). Delaying maintenance and rehabilitation (M&R) until a pavement structure has seriously degraded can cost many times more than if M&R was applied earlier in a pavement's life cycle, as shown in Figure 1. From a safety perspective, pavement distresses, such as cracks and loose debris, may pose risks in terms of the potential for aircraft tire damage and the ability of a pilot to safely control aircraft.

Figure 1. Pavement condition versus cost of repair.



The pavement evaluation results for Oelwein Municipal Airport are presented within this report and can be used by Oelwein Municipal Airport, the Iowa DOT, and the Federal Aviation Administration (FAA) to identify, prioritize, and schedule pavement M&R actions at the airport. In addition to this report, the web-based interactive pavement data visualization tool IDEA, containing the information collected during this project, was updated and may be accessed from the Iowa DOT's website or directly (Iowa APMS IDEA).

PAVEMENT INVENTORY

The project began with a review of the existing inventory information pertaining to the pavements at Oelwein Municipal Airport. The date of original construction, along with the date of any subsequent rehabilitation; the location of completed work; and the type of work undertaken were gathered. The information was used to update the pavement management database and associated maps, as necessary, to account for pavement-related work that had been undertaken since the last time the airport was evaluated in 2019.

The pavement network at Oelwein Municipal Airport was then divided into branches, sections, and sample units. A branch is a single entity that serves a distinct function. For example, a runway is considered a branch because it serves a single function (allowing aircraft to take off and land). Taxiways, aprons, and T-hangars are also separate branches.

Each branch was further divided into sections. Traditionally, sections are defined as parts of the branch that share common attributes, such as cross-section, date of last construction, traffic level, and performance. Using this approach, if a runway was built in 1968 and then extended in 1984, it would contain two separate sections.

To estimate the overall condition of a pavement section, each section was subdivided into sample units. Portions of these sample units were evaluated during the pavement inspection, and the collected information was extrapolated to predict the overall section condition and quantities of distress.

Approximately 473,600 square feet of pavement were evaluated at Oelwein Municipal Airport, as illustrated in Figure 2. This figure also shows the area-weighted age, in years, of the pavements at the time of the inspection. Figure 3 provides a map that details how the pavement network was divided into management units and identifies the sample units that were evaluated during the pavement inspection at Oelwein Municipal Airport.

Figure 2. Pavement area by branch use at Oelwein Municipal Airport.

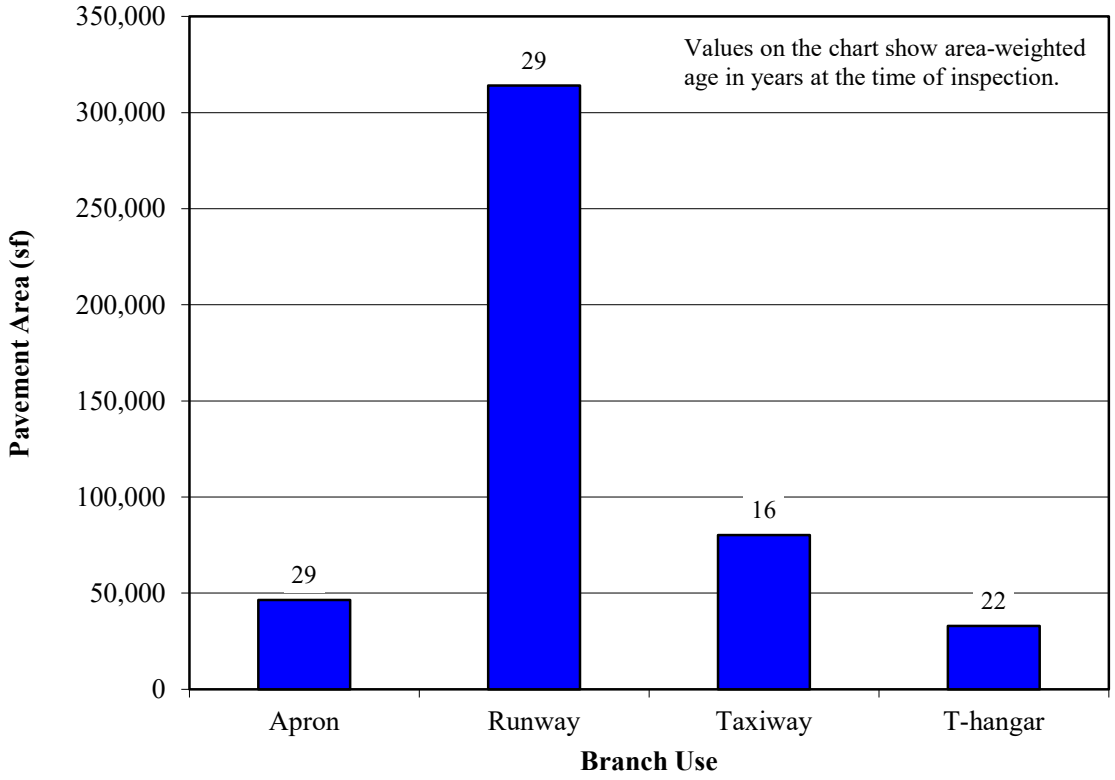
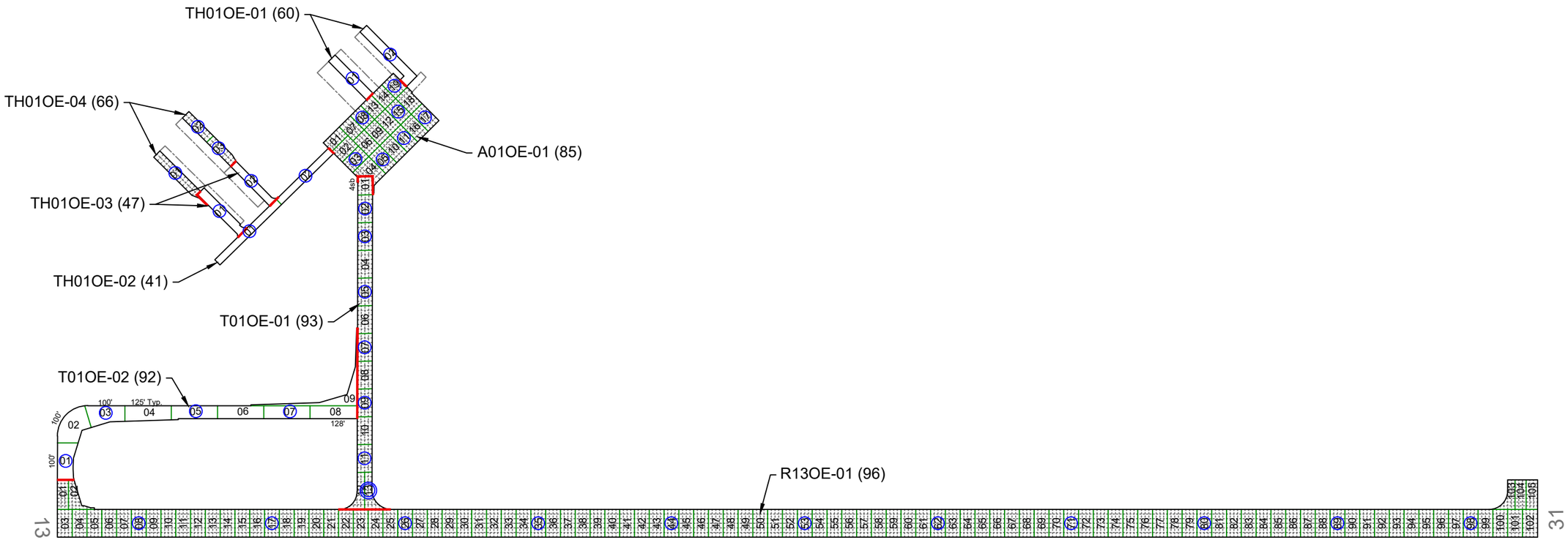


FIGURE 3. NETWORK DEFINITION MAP.



NETWORK DEFINITION LEGEND

- R16ES-01 (88): BRANCH IDENTIFIER / SECTION IDENTIFIER / PCI VALUE
- SECTION BREAK LINE
- SAMPLE UNIT BREAK LINE
- SLAB JOINT
- 03: SAMPLE UNIT NUMBER
- 03: SAMPLE UNIT INSPECTED
- 03: ADDITIONAL SAMPLE UNIT

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AGENCY:	Iowa Department of Transportation Modal Transportation Bureau
LOCATION:	Oelwein Municipal Airport Oelwein, Iowa
PAGE TITLE:	Network Definition Map

PROJECT DATE:	CREATION DATE:	PROJECT MANAGER:	JOB NUMBER:
OCT. 2022	OCT. 2022	LJR	2021-125-AM01
DRAWING SCALE:	LAST MODIFIED DATE:	REVISED BY:	DRAWN BY:
1"=300'	JAN. 2023	DMS	KEW
FILENAME:		LAYOUT NAME/NUMBER:	PAGE NUMBER:
Oelwein.dwg		NET. DEF.	5

PAVEMENT EVALUATION

Pavement Evaluation Procedure

APTech inspected the pavements at Oelwein Municipal Airport using the PCI procedure described in:

- FAA Advisory Circular 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*.
- FAA Advisory Circular 150/5380-7B, *Airport Pavement Management Program (PMP)*.
- ASTM D5340-20, *Standard Test Method for Airport Pavement Condition Index Surveys*.

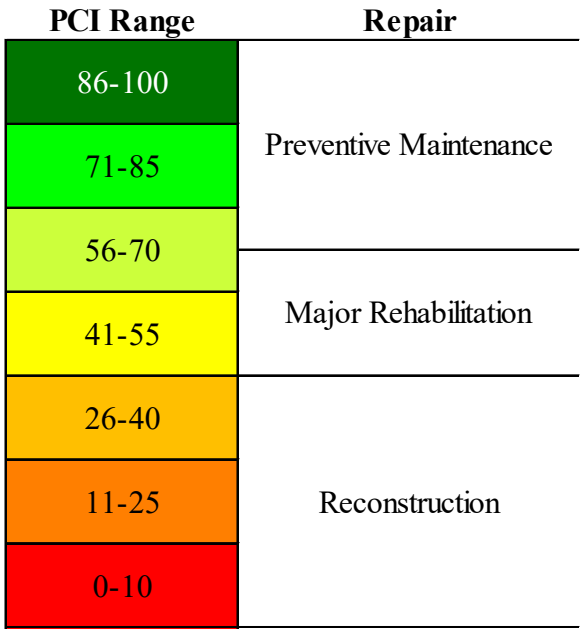
The PCI provides a numerical indication of overall pavement condition, as illustrated in Figure 4. The types and amounts of deterioration are used to calculate the PCI of the section. The PCI ranges from a value of 0, which represents a pavement in a failed condition, to a value of 100, which represents a pavement in excellent condition. It is important to note that factors other than overall PCI need to be considered when identifying the appropriate type of repair, including types of distress present and rate of deterioration. Also, since the PCI does not assess the structural integrity or capacity of the pavement structure, further testing may be needed to validate and refine the treatment strategy.

Figure 4. Visual representation of PCI scale on typical pavement surfaces.

Note: Photographs shown are not specific to Oelwein Municipal Airport.

Generally, pavements with relatively high PCIs that are not exhibiting significant load-related distress will benefit from preventive maintenance actions, such as crack sealing or joint resealing. As the PCI drops, the pavements may require major rehabilitation, such as an overlay or whitetopping. In some situations where the PCI has dropped low enough, reconstruction may be the only viable alternative due to the substantial damage to the pavement structure. Figure 5 illustrates how the appropriate repair type varies with the PCI of a pavement section and provides the corresponding colors used for the maps and charts in this report for each range of PCIs.

Figure 5. PCI versus repair type.



The types of distress identified during the PCI inspection provide insight into the cause of pavement deterioration, which is useful when selecting M&R strategies. Understanding the cause of distress helps in selecting a rehabilitation alternative that corrects the cause and thus eliminates or delays its recurrence. PCI distress types are characterized as:

- Load-related—These distress types are defined as being caused by aircraft or vehicular traffic and may indicate a structural deficiency. Examples of load-related distress include alligator cracking on asphalt-surfaced pavements and corner breaks on portland cement concrete (PCC) pavements.
- Climate/durability-related—These distress types often signify the presence of aged or environmentally susceptible (or both) material and include durability-related issues. Examples of climate/durability-related distress include weathering on asphalt-surfaced pavements, which is climate-related, and durability cracking on PCC pavements, which is durability-related.
- Other—Distress types that fall into this category cannot be attributed solely to load or climate/durability. Examples of this type of distress include depressions on asphalt-surfaced pavements and shrinkage cracking on PCC pavements.

Appendix A identifies the distress types considered during a PCI inspection and describes the likely cause of each distress type. It should be noted that a PCI is based on visual signs of pavement deterioration and does not provide a measure of structural capacity.

Pavement Evaluation Results

The pavements at Oelwein Municipal Airport were inspected in November 2022. The 2022 area-weighted condition of Oelwein Municipal Airport is 91, with conditions ranging from 41 to 96 (on a scale of 0 [failed] to 100 [excellent]). During the previous pavement inspection in 2019, the area-weighted PCI of the airport was 91.

Figure 6 summarizes the overall condition of the pavements at Oelwein Municipal Airport, and Figure 7 presents area-weighted condition (average PCI adjusted to account for the relative size of the pavement sections) by branch use. Figure 8 is a map that displays the condition of the evaluated pavements. Table 1 summarizes the results of the pavement evaluation. Appendix B presents photographs taken during the PCI inspection, and Appendix C contains detailed information on the distress types observed during the visual survey. Appendix D includes detailed work history information that was collected during the record review process.

Figure 6. Pavement area by PCI range at Oelwein Municipal Airport.

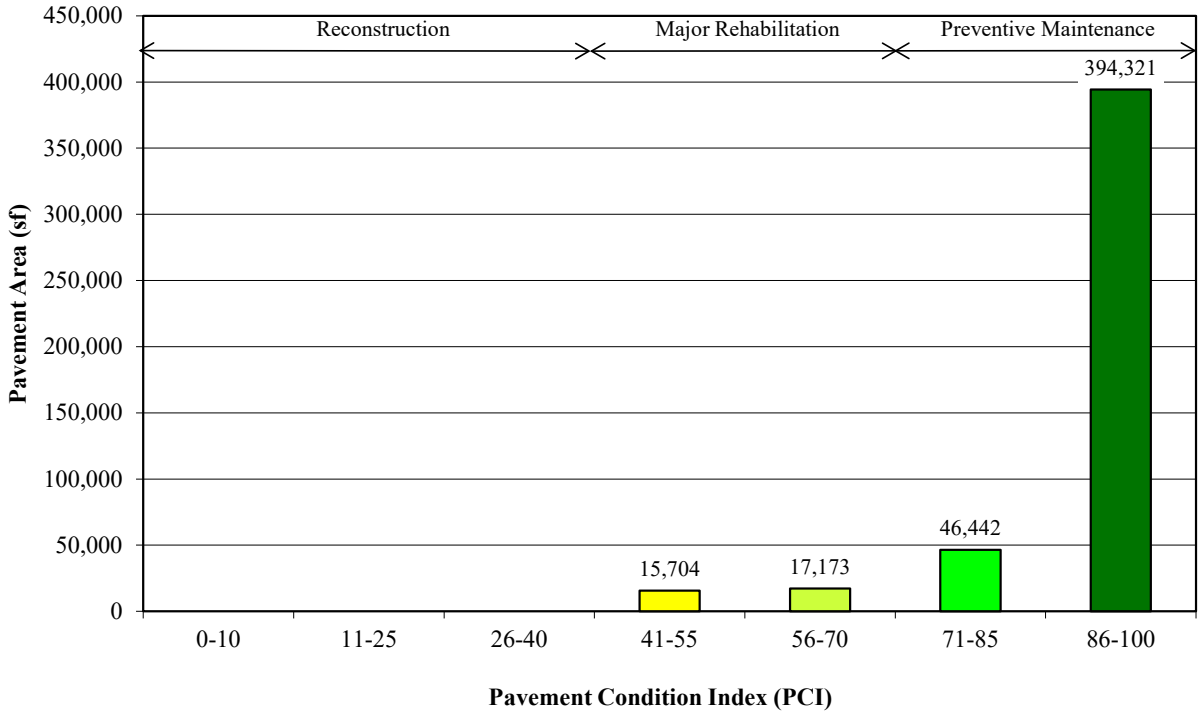


Figure 7. Area-weighted PCI by branch use at Oelwein Municipal Airport.
(Values on chart are area-weighted)

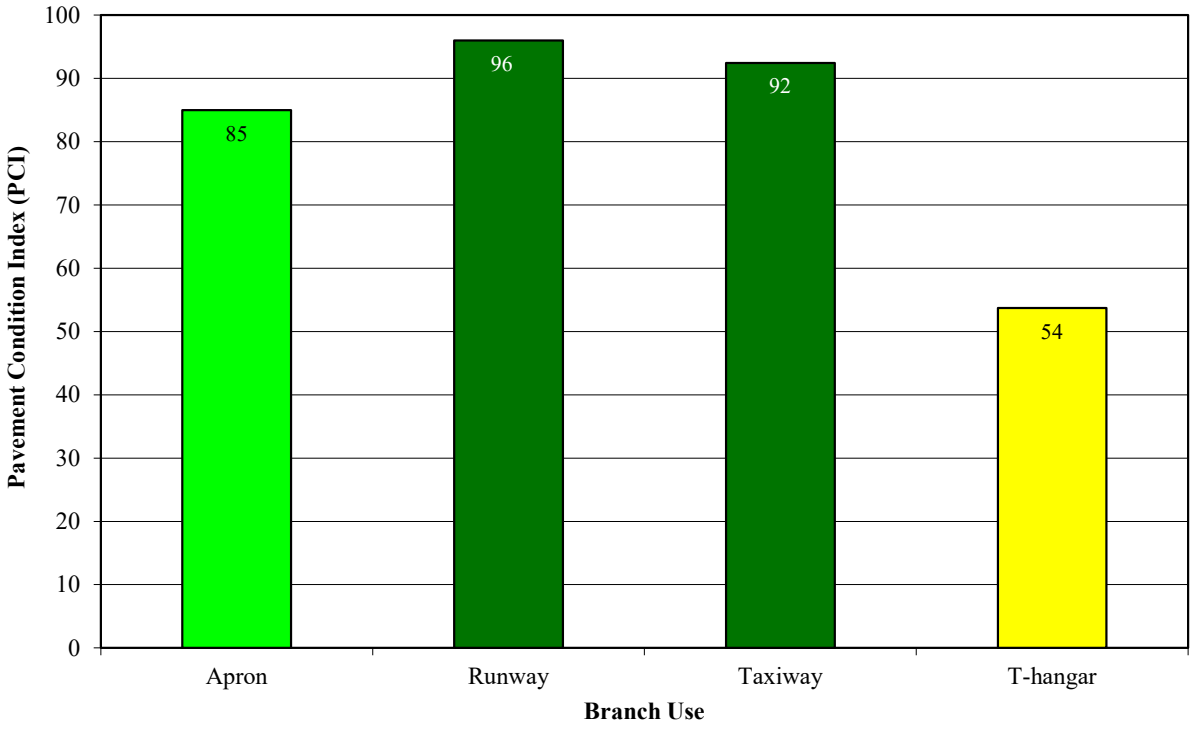
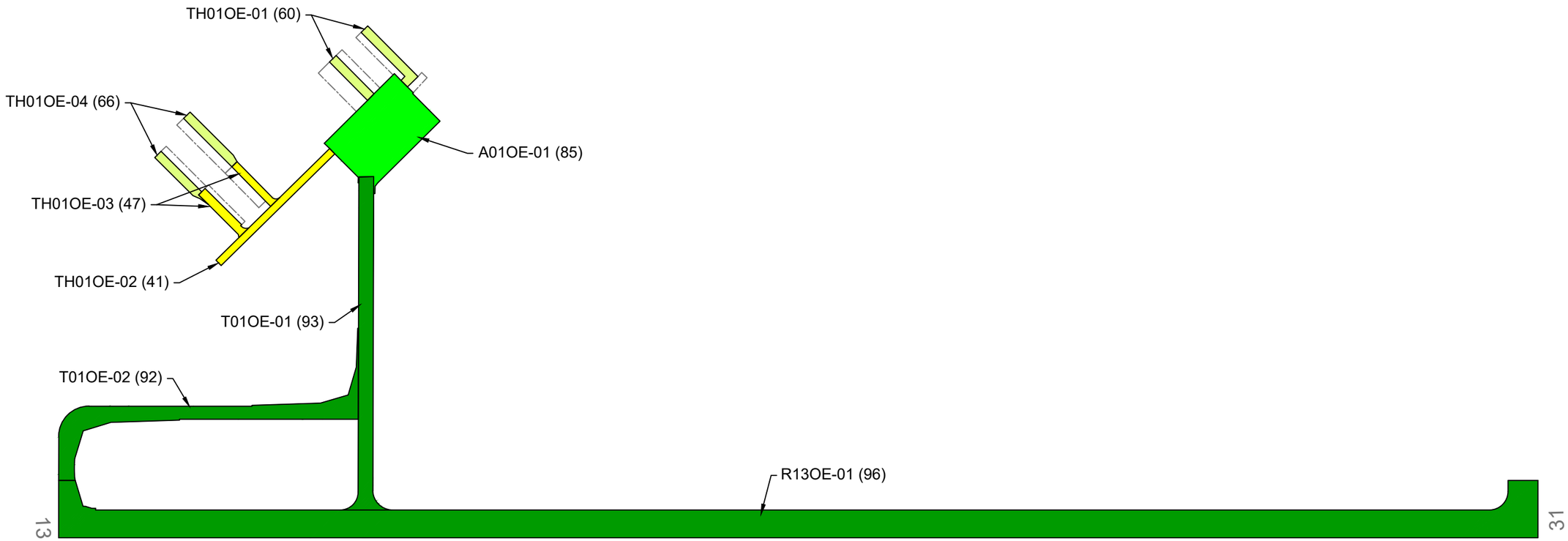


FIGURE 8. PCI MAP.



LEGEND

R16ES-01 (88)

- BRANCH IDENTIFIER
- SECTION IDENTIFIER
- PCI VALUE
- SECTION BREAK LINE

PAVEMENT CONDITION INDEX

PCI

86-100
71-85
56-70
41-55
26-40
11-25
0-10

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AGENCY: Iowa Department of Transportation, Modal Transportation Bureau			
LOCATION: Oelwein Municipal Airport, Oelwein, Iowa			
PAGE TITLE: 2022 Pavement Condition Index Map			
PROJECT DATE: OCT. 2022	CREATION DATE: OCT. 2022	PROJECT MANAGER: LJR	JOB NUMBER: 2021-125-AM01
DRAWING SCALE: 1"=300'	LAST MODIFIED DATE: MAR. 2023	REVISED BY: DMS	DRAWN BY: KEW
FILENAME: Oelwein.dwg		LAYOUT NAME/NUMBER: PCI	PAGE NUMBER: 10

Table 1. 2022 pavement evaluation results.

Branch	Section	Surface Type	Section Area (sf)	LCD	2022 PCI	% Distress Due to Load	% Distress Due to Climate/ Durability	% Distress Due to Other	Type of Distress
A01OE	01	PCC	46,442	6/1/1993	85	76	0	24	Corner Break, Corner Spalling, Faulting, Joint Spalling, Large Patch, LTD Cracking, Small Patch
R13OE	01	PCC	314,028	6/1/1993	96	0	0	100	Corner Spalling, Faulting, Joint Spalling, Large Patch, Small Patch
T01OE	01	PCC	37,130	6/1/1993	93	53	0	47	Corner Spalling, Joint Spalling, Large Patch, LTD Cracking, Small Patch
T01OE	02	AC	43,163	9/22/2018	92	0	100	0	L&T Cracking, Weathering
TH01OE	01	AC	8,858	6/1/2004	60	23	77	0	Alligator Cracking, Block Cracking, L&T Cracking, Weathering
TH01OE	02	AC	8,660	1/1/1994	41	45	47	8	Alligator Cracking, Depression, L&T Cracking, Patching, Rutting, Weathering
TH01OE	03	AC	7,044	6/1/1994	47	21	79	0	Alligator Cracking, Block Cracking, L&T Cracking, Weathering
TH01OE	04	PCC	8,315	11/1/2008	66	74	23	3	Corner Break, Corner Spalling, Joint Seal Damage, LTD Cracking

Table Notes:

1. See Figure 3 for the location of the branch and section.
2. Surface Type: AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.
3. LCD = last construction date.
4. Distress due to load includes distress types that are attributed to a structural deficiency in the pavement, such as alligator cracking or rutting on asphalt-surfaced pavements or shattered slabs on PCC pavements.
5. Distress due to climate or durability includes distress types that are attributed to either the aging of the pavement and the effects of the environment (such as weathering, raveling, or block cracking on asphalt-surfaced pavements) or to a materials-related problem (such as durability cracking or alkali-silica reaction [ASR] on PCC pavements). If materials-related distresses were recorded during the inspection, further laboratory testing is required to definitively determine the type present.
6. Distress due to other refers to distress types that are not attributed to one factor but rather may be caused by a combination of factors.
7. Distress types are defined by ASTM D5340-20. L&T Cracking = Longitudinal and Transverse Cracking; LTD Cracking = Longitudinal, Transverse, and Diagonal Cracking; ASR = Alkali-Silica Reaction.

Inspection Comments

Oelwein Municipal Airport was inspected on November 13, 2022. There were eight pavement sections defined during the inspection.

Runway

Runway 13/31 contained one section. Section 01 was in excellent condition with low-severity corner spalling, faulting, joint spalling, large patching, and small patching noted during the inspection.

Taxiway

Taxiway 01 was defined by two sections. Section 01 contained areas of low-severity joint spalling, large patching, and small patching; low- and high-severity corner spalling; and medium-severity longitudinal, transverse, and diagonal (LTD) cracking. Areas of low-severity longitudinal and transverse (L&T) cracking and weathering were observed in Section 02. The low-severity cracking in Section 02 was unsealed.

Apron

The apron area consisted of one section. Section 01 contained areas of low-severity small patching, corner spalling, faulting, joint spalling, and large patching; medium-severity corner break; and low- and medium-severity LTD cracking.

T-Hangar

The T-hangar area was defined by four sections. Medium-severity alligator cracking, low-severity block cracking, and low- and medium-severity L&T cracking and weathering were observed in Section 01. Section 02 contained low- and medium-severity L&T cracking and alligator cracking, high-severity depression and patching, low-severity rutting, and medium-severity weathering at the time of inspection. The low-severity cracking in Sections 01 and 02 was unsealed, and the medium-severity cracking was due to either the development of secondary cracking or unsealed crack widths that exceeded ¼ in. Medium-severity alligator cracking and weathering, low-severity block cracking, and low- and medium-severity L&T cracking were identified in Section 03. Section 04 contained areas of medium-severity corner break and corner spalling, high-severity joint seal damage, and low- and medium-severity LTD cracking.

PAVEMENT MAINTENANCE AND REHABILITATION PROGRAM

Using the information collected during the pavement inspection, the PAVER pavement management software was used to develop a 5-year M&R program for Oelwein Municipal Airport. In addition, a 1-year plan for localized preventive maintenance (such as crack sealing and patching) was prepared.

Analysis Parameters

Critical PCIs

PAVER uses critical PCIs to determine whether localized preventive maintenance or major rehabilitation is the appropriate repair action. Above the critical PCI, localized preventive maintenance activities are recommended. Below the critical PCI, major rehabilitation actions, such as an overlay or reconstruction, are recommended. The Iowa DOT set the critical PCIs at 65 for runways, 60 for taxiways, and 55 for aprons and T-hangars.

Localized Preventive Maintenance Policies and Unit Costs

Localized preventive maintenance policies were developed for asphalt-surfaced and PCC pavements. These policies, shown in Appendix E, identify the localized preventive maintenance actions that the Iowa DOT considered appropriate to correct the different distress types and severities. The Iowa DOT provided unit costs for each of the localized preventive maintenance actions included in these policies, and these costs are detailed in Appendix E. Please note that this information is of a general nature for the entire state. The localized preventive maintenance policies and unit costs may require adjustment to reflect specific conditions at Oelwein Municipal Airport.

Major Rehabilitation Unit Costs

PAVER estimates the cost of major rehabilitation based on the predicted PCI of the pavement section. The Iowa DOT provided the costs for major rehabilitation, and they are presented in Appendix E. If major rehabilitation is recommended in the 5-year program, further engineering investigation will be needed to identify the most appropriate rehabilitation action and to estimate the cost of such work more accurately.

Budget and Inflation Rate

An unlimited budget with a start date of July 1, 2023 and an inflation rate of 4.0 percent was used during the analysis.

Analysis Approach

The 5-year M&R program was prepared with the goal of maintaining the pavements above established critical PCIs. During this analysis, major rehabilitation was recommended for pavements in the year they dropped below their critical PCI. For the first year (2023) of the analysis only, a localized preventive maintenance plan was developed for those pavement sections that were above their critical PCI. If major rehabilitation was triggered for a section in 2024 or 2025, then localized preventive maintenance was not recommended for 2023. While localized preventive maintenance should be an annual undertaking at Oelwein Municipal Airport, it is not possible to accurately predict the propagation of cracking and other distress types. Therefore, the airport should budget for maintenance every year and can use the 2023

localized preventive maintenance plan as a baseline for that work. As the pavements age, it can be assumed that the amount of localized preventive maintenance required will increase.

Analysis Results

A summary of the M&R program for Oelwein Municipal Airport is presented in Table 2. Detailed information on the recommended localized preventive maintenance plan for 2023 is provided in Appendix F.

Table 2. 5-year M&R program under an unlimited funding analysis scenario.

Year	Branch	Section	Surface Type	Type of Repair	Estimated Cost
2023	A01OE	01	PCC	Preventive Maintenance	$2,218
2023	T01OE	01	PCC	Preventive Maintenance	$607
2023	TH01OE	02	AC	Major Rehabilitation	$93,705
2023	TH01OE	03	AC	Major Rehabilitation	$54,014
2023	TH01OE	04	PCC	Preventive Maintenance	$4,749
2025	TH01OE	01	AC	Major Rehabilitation	$49,053
				Total Estimated Cost:	**$205,000**

Table Notes:

1. See Figure 3 for the location of the branch and section.
2. Surface Type: AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.
3. Type of Repair: Major Rehabilitation such as pavement reconstruction or an overlay; Localized Preventive Maintenance such as crack sealing or patching.
4. The estimated costs provided are of a general nature for the entire state and may require adjustment to reflect specific conditions at Oelwein Municipal Airport.

The recommendations made in this report are based on a broad network-level analysis and meant to provide Oelwein Municipal Airport with an indication of the type of pavement-related work required during the next 5 years. Further engineering investigation may be necessary to identify which repair action is most appropriate. In addition, the cost estimates provided are based on overall unit costs for the entire state, and Oelwein Municipal Airport should adjust the plan to reflect local costs.

Because an unlimited budget was used in the analysis, it is possible that the pavement repair program may need to be adjusted to consider economic or operational constraints. The identification of a project need does not necessarily mean that state or federal funding will be available in the year it is indicated. It is important to remember that regardless of the recommendations presented within this report, Oelwein Municipal Airport is responsible for repairing pavements where existing conditions pose a hazard to safe operations.

General Maintenance Recommendations

In addition to the specific maintenance actions presented in Appendix F, it is recommended that the following strategies be considered for prolonging pavement life:

1. Regularly inspect all safety areas of the airport and document all inspection activity. A sample form that can be used to perform these inspections is provided in Table 3 of this report.
2. Provide a method of tracking all maintenance activities that occur as a result of inspections. These need to be reported to the FAA and the Iowa DOT. This information is used to update the APMS records and is required to remain in compliance with Public Law 103-305 (see the next section of this report for further information on this law).
3. Conduct an aggressive campaign against weed growth through timely herbicide applications and mowing programs of the safety areas. Vegetation growth in pavement cracks is destructive and significantly increases the rate of pavement deterioration.
4. Implement a periodic crack and joint sealing program. Keeping water and debris out of the pavement system by sealing cracks and joints is a proven and cost-effective method of extending the life of the pavement system.
5. Ensure that dirt does not build up along the edges of the pavements. This can create a "bathtub" effect, reducing the ability of water to drain away from the pavement system.
6. Closely monitor the movement of heavy equipment (particularly farming, construction, and fueling equipment) to make sure it is only operating on pavements that are designed to accommodate heavy loads. Failure to restrict heavy equipment to appropriate areas may result in the premature failure of airport pavements.

FAA Requirements (Public Law 103-305)

Because Oelwein Municipal Airport is in the National Plan of Integrated Airport Systems (NPIAS), the airport sponsor is required to keep the airport in a viable operating condition. This includes maintaining airport pavements in accordance with Public Law 103-305. Public Law 103-305 states that after January 1, 1995, NPIAS airport sponsors must provide assurances or certifications that an airport has implemented an effective airport pavement maintenance management system (PMMS) before the airport will be considered for federal funding of pavement replacement or reconstruction projects. To be in full compliance with the federal law, the PMMS must include the following components at minimum: pavement inventory, pavement inspections, record keeping, information retrieval, and program funding.

This report serves as a complete pavement inventory and detailed inspection. To remain in compliance with the law, Oelwein Municipal Airport will also need to undertake monthly drive-by inspections of pavement conditions and track pavement-related maintenance activities.

FAA Advisory Circular 150/5380-7B provides detailed guidance pertaining to the requirements for an acceptable pavement management program (PMP). Appendix A of the FAA Advisory Circular 150/5380-7B outlines what needs to be included in a PMP to remain in compliance with this law and Grant Assurance #11. The following is a copy of this Appendix, along with instructions for supplementing this report so that all requirements are met. Note that the italicized words are direct quotations from the FAA Advisory Circular.

FAA Advisory Circular 150/5830-7B, Appendix A. Pavement Management Program (PMP)

A-1.0. *An effective PMP specifies the procedures to follow to assure that proper preventative and remedial pavement maintenance is performed. The program should identify funding or anticipated funding and other resources available to provide remedial and preventive maintenance activities. An airport sponsor may use any format deemed appropriate, but the program needs to, as a minimum, include the following:*

A-1.1. Pavement Inventory. *The following must be depicted:*

a. Identification of all runways, taxiways, and aprons with pavement broken down into sections each having similar properties.

The network definition map provided in Figure 3 of this report shows the location of all runways, taxiways, aprons, and T-hangars at Oelwein Municipal Airport. If any new pavements are constructed or any pavement areas are permanently closed, this map must be updated. Project plans should be submitted to the Iowa DOT after project completion.

b. Dimensions of pavement sections.

The dimensions of all runways, taxiways, aprons, and T-hangars are stored in the PAVER database. Appendix C provides information on length, width, and area. In addition, the network definition map provided in Figure 3 is drawn to scale. Any changes to pavement dimensions must be recorded.

c. Type of pavement surface.

The type of pavement for each section at Oelwein Municipal Airport is listed in Table 1 of this report and is also stored in the PAVER database. Any changes to the pavement type (through an overlay or reconstruction) must be recorded.

d. Year of construction and/or most recent major rehabilitation.

Dates for pavement construction, rehabilitation, or reconstruction must be recorded. The current pavement history for Oelwein Municipal Airport is provided in Appendix D of this report.

e. Whether AIP [Airport Improvement Program] or PFC [Passenger Facility Charge] funds were used to construct, reconstruct, or repair the pavement.

Funding sources for all pavement projects should be recorded.

A-1.2. PMP Pavement Inspection Schedule. *Airports must perform a detailed inspection of airfield pavements at least once a year for the PMP. If a pavement condition index (PCI) survey is performed, as set forth in ASTM D5340, Standard Test Method for Airport Pavement Condition Index Surveys, the frequency of the detailed inspection by PCI surveys may be extended to three years. Less comprehensive routine daily, weekly, and monthly maintenance inspections required for operations should be addressed.*

This report consists of a detailed inspection that will extend the inspection period to 3 years. It is the airport sponsor's responsibility to perform monthly drive-by inspections. A sample pavement inspection report form is provided in Table 3 of this report.

A-1.3. Record Keeping. *The airport must record and keep on file complete information about all detailed inspections and maintenance performed until the pavement system is replaced. The types of distress, their locations, and remedial action, scheduled or performed, must be documented. The minimum information recorded includes:*

a. *Inspection date*

b. Location

c. Distress types

d. Maintenance scheduled or performed

Items a through c are satisfied by this inspection report. Item d is the responsibility of the airport, as is record keeping of the monthly drive-by inspections.

A-1.4. Information Retrieval. *An airport sponsor may use any form of record keeping it deems appropriate so long as the information and records from the pavement survey can generate required reports, as necessary.*

Keep this report, monthly drive-by inspection reports, construction updates, and all records of maintenance activities in a readily accessible location so that they can be easily retrieved as requested by the FAA.

Table 3. Pavement inspection report.

Inspected By: _____

Date Inspected: _____

Branch	Section	Distress Description/Dimensions/Severity/ Recommended Action	Description of Repair	Date Performed	Cost	Funding Source
A01OE	01					
R13OE	01					
T01OE	01					
T01OE	02					
TH01OE	01					
TH01OE	02					

Table 3. Pavement inspection report (continued).

Inspected By: _____

Date Inspected: _____

Branch	Section	Distress Description/Dimensions/Severity/ Recommended Action	Description of Repair	Date Performed	Cost	Funding Source
TH01OE	03					
TH01OE	04					

Table Note: See Figure 3 for the location of the branch and section.

SUMMARY

This report documents the results of the pavement evaluation conducted at Oelwein Municipal Airport. A visual inspection of the pavements in 2022 found that the overall condition of the pavement network is a PCI of 91. A 5-year pavement repair program, shown in Table 2, was generated for Oelwein Municipal Airport, which revealed that approximately $205,000 needs to be expended on M&R. Oelwein Municipal Airport should utilize these study results to assist in planning for future maintenance needs as part of the airport CIP planning process.

APPENDIX A

CAUSE OF DISTRESS TABLES

Table A-1. Cause of pavement distress, asphalt-surfaced pavements.

Distress Type	Probable Cause of Distress
Alligator Cracking	Fatigue failure of the asphalt surface under repeated traffic loading.
Bleeding	Excessive amounts of asphalt cement or tars in the mix or low air void content, or both.
Block Cracking	Shrinkage of the asphalt and daily temperature cycling; it is not load associated.
Corrugation	Traffic action combined with an unstable pavement layer.
Depression	Settlement of the foundation soil or can be "built up" during construction.
Jet-Blast Erosion	Bituminous binder has been burned or carbonized.
Joint Reflection Cracking	Movement of the concrete slab beneath the asphalt surface due to thermal and moisture changes.
L&T Cracking	Cracks may be caused by (1) a poorly constructed paving lane joint, (2) shrinkage of the asphalt surface due to low temperatures or hardening of the asphalt, or (3) reflective cracking caused by cracks in an underlying PCC slab.
Oil Spillage	Deterioration or softening of the pavement surface caused by the spilling of oil, fuel, or other solvents.
Patching	N/A
Polished Aggregate	Repeated traffic applications.
Raveling	Asphalt binder may have hardened significantly, causing coarse aggregate pieces to dislodge.
Rutting	Usually caused by consolidation or lateral movement of the materials due to traffic loads.
Shoving	Where PCC pavements adjoin flexible pavements, PCC "growth" may shove the asphalt pavement.
Slippage Cracking	Low strength surface mix or poor bond between the surface and the next layer of the pavement structure.
Swelling	Usually caused by frost action or by swelling soil.
Weathering	Asphalt binder and/or fine aggregate may wear away as the pavement ages and hardens.

Table A-2. Cause of pavement distress, PCC pavements.

Distress Type	Probable Cause of Distress
ASR	Chemical reaction of alkalis in the portland cement with certain reactive silica minerals. ASR may be accelerated by the use of chemical pavement deicers.
Blowup	Incompressible materials in the joints.
Corner Break	Load repetition combined with loss of support and curling stresses.
Durability Cracking	Concrete's inability to withstand environmental factors such as freeze-thaw cycles.
Faulting	Upheaval or consolidation.
Joint Seal Damage	Stripping of joint sealant, extrusion of joint sealant, weed growth, hardening of the filler (oxidation), loss of bond to the slab edges, or absence of sealant in the joint.
LTD Cracking	Combination of load repetition, curling stresses, and shrinkage stresses.
Patching (Small and Large)	N/A
Popouts	Freeze-thaw action in combination with expansive aggregates.
Pumping	Poor drainage, poor joint sealant.
Scaling	Over finishing of concrete, deicing salts, improper construction, freeze-thaw cycles, and poor aggregate.
Shattered Slab	Load repetition.
Shrinkage Cracking	Setting and curing of the concrete.
Spalling (Joint and Corner)	Excessive stresses at the joint caused by infiltration of incompressible materials or traffic loads; weak concrete at the joint combined with traffic loads.

APPENDIX B

INSPECTION PHOTOGRAPHS

A01OE-01. Overview.

A01OE-01. LTD Cracking (Sample Unit No. 03).

R13OE-01. Overview.

R13OE-01. Large Patching (Sample Unit No. 44).

R13OE-01. Small Patching (Sample Unit No. 08).

T01OE-01. Overview.

T01OE-01. Joint Spalling (Sample Unit No. 07).

T01OE-01. Small Patching (Sample Unit No. 07).

T01OE-02. Overview.

T01OE-02. L&T Cracking (Sample Unit No. 05).

T01OE-02. Weathering (Sample Unit No. 05).

TH01OE-01. Overview.

TH01OE-01. L&T Cracking (Sample Unit No. 02).

TH01OE-01. Weathering (Sample Unit No. 02).

TH01OE-02. Overview.

TH01OE-02. Alligator Cracking (Sample Unit No. 02).

TH01OE-02. L&T Cracking (Sample Unit No. 02).

TH01OE-02. Weathering (Sample Unit No. 02).

TH01OE-03. Overview.

TH01OE-03. Block Cracking (Sample Unit No. 01).

TH01OE-04. Overview.

TH01OE-04. Joint Seal Damage (Sample Unit No. 01).

TH01OE-04. LTD Cracking (Sample Unit No. 01).

APPENDIX C

INSPECTION REPORT

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: A01OE - 001

Branch Name: APRON Use: APRON

LCD: 6/1/1993
Surface Type: PCC
Rank: P
Section Area (sf): 46,442.00
Length (ft): 260.00
Width (ft): 170.00
From: BUILDING
To: TAXIWAY 01

PCI Family: IowaPCCAPNCE_Gen

Slabs: 436
Slab Length (ft): 10.00
Slab Width (ft): 10.00
Joint Length (ft): 8,295.27

Section Comments:

Last Insp Date: 11/13/2022
PCI: 85
Total Samples: 19
Surveyed: 7

Inspection Comments:

Sample Number: 003

Sample Type: R
Sample PCI: 87
Sample Area (Slabs): 24.00

Sample Comments:

63 LINEAR CRACKING	L	3.00	Slabs
74 JOINT SPALL	L	2.00	Slabs

Sample Number: 005

Sample Type: R
Sample PCI: 87
Sample Area (Slabs): 24.00

Sample Comments:

63 LINEAR CRACKING	L	1.00	Slabs
63 LINEAR CRACKING	M	1.00	Slabs

Sample Number: 008

Sample Type: R
Sample PCI: 78
Sample Area (Slabs): 20.00

Sample Comments:

62 CORNER BREAK	M	1.00	Slabs
67 LARGE PATCH	L	2.00	Slabs
71 FAULTING	L	3.00	Slabs

Sample Number: 011

Sample Type: R
Sample PCI: 78
Sample Area (Slabs): 24.00

Sample Comments:

63 LINEAR CRACKING	M	3.00	Slabs
66 SMALL PATCH	L	1.00	Slabs

Sample Number: 015

Sample Type: R
Sample PCI: 92
Sample Area (Slabs): 24.00

Sample Comments:

74 JOINT SPALL	L	2.00	Slabs
75 CORNER SPALL	L	3.00	Slabs

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Sample Number: 017

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00

Sample Comments:

NO DISTRESS

Sample Number: 019

Sample Type: R
Sample PCI: 70
Sample Area (Slabs): 20.00

Sample Comments:

63 LINEAR CRACKING	M	4.00	Slabs
74 JOINT SPALL	L	1.00	Slabs

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: R13OE - 001

Branch Name: RUNWAY 13/31 Use: RUNWAY

LCD: 6/1/1993
Surface Type: PCC
Rank: P
Section Area (sf): 314,028.00
Length (ft): 4,001.00
Width (ft): 75.00
From: RUNWAY END 13
To: RUNWAY END 31

PCI Family: IowaPCCRWNCE_GenBasicLocal

Slabs: 2,512
Slab Length (ft): 12.50
Slab Width (ft): 10.00
Joint Length (ft): 52,259.51

Section Comments:

Last Insp Date: 11/13/2022
PCI: 96
Total Samples: 105
Surveyed: 11

Inspection Comments:

Sample Number: 08

Sample Type: R
Sample PCI: 98
Sample Area (Slabs): 24.00

Sample Comments:

66 SMALL PATCH	L	2.00	Slabs

Sample Number: 17

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00

Sample Comments:

NO DISTRESS

Sample Number: 26

Sample Type: R
Sample PCI: 99
Sample Area (Slabs): 24.00

Sample Comments:

66 SMALL PATCH	L	1.00	Slabs

Sample Number: 35

Sample Type: R
Sample PCI: 93
Sample Area (Slabs): 24.00

Sample Comments:

71 FAULTING	L	2.00	Slabs

Sample Number: 44

Sample Type: R
Sample PCI: 93
Sample Area (Slabs): 24.00

Sample Comments:

67 LARGE PATCH	L	3.00	Slabs

Sample Number: 53

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00

Sample Comments:

NO DISTRESS

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Sample Number: 62

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00
Sample Comments:

NO DISTRESS

Sample Number: 71

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00
Sample Comments:

NO DISTRESS

Sample Number: 80

Sample Type: R
Sample PCI: 99
Sample Area (Slabs): 24.00
Sample Comments:

66 SMALL PATCH	L	1.00	Slabs

Sample Number: 89

Sample Type: R
Sample PCI: 81
Sample Area (Slabs): 24.00
Sample Comments:

66 SMALL PATCH	L	1.00	Slabs
67 LARGE PATCH	L	2.00	Slabs
71 FAULTING	L	4.00	Slabs

Sample Number: 98

Sample Type: R
Sample PCI: 96
Sample Area (Slabs): 24.00
Sample Comments:

74 JOINT SPALL	L	2.00	Slabs
75 CORNER SPALL	L	1.00	Slabs

Branch - Section ID: T01OE - 001

Branch Name: TAXIWAY 01 Use: TAXIWAY

LCD: 6/1/1993
Surface Type: PCC
Rank: P
Section Area (sf): 37,130.00
Length (ft): 910.00
Width (ft): 40.00
From: APRON 01
To: RUNWAY 13/31

PCI Family: IowaPCCTWNCE_GenBasicLocal

Slabs: 297
Slab Length (ft): 12.50
Slab Width (ft): 10.00
Joint Length (ft): 5,714.35

Section Comments:

Last Insp Date: 11/13/2022
PCI: 93
Total Samples: 13
Surveyed: 7

Inspection Comments:

Sample Number: 002

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00

Sample Comments:

NO DISTRESS

Sample Number: 003

Sample Type: R
Sample PCI: 96
Sample Area (Slabs): 24.00

Sample Comments:

66 SMALL PATCH	L	4.00	Slabs
74 JOINT SPALL	L	1.00	Slabs

Sample Number: 005

Sample Type: R
Sample PCI: 94
Sample Area (Slabs): 24.00

Sample Comments:

74 JOINT SPALL	L	1.00	Slabs
75 CORNER SPALL	H	1.00	Slabs

Sample Number: 007

Sample Type: R
Sample PCI: 74
Sample Area (Slabs): 24.00

Sample Comments:

63 LINEAR CRACKING	M	2.00	Slabs
66 SMALL PATCH	L	2.00	Slabs
74 JOINT SPALL	L	2.00	Slabs
75 CORNER SPALL	H	1.00	Slabs
75 CORNER SPALL	L	1.00	Slabs

Sample Number: 009

Sample Type: R
Sample PCI: 100
Sample Area (Slabs): 24.00

Sample Comments:

NO DISTRESS

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Sample Number: 011

Sample Type: R
Sample PCI: 99
Sample Area (Slabs): 24.00

Sample Comments:

66 SMALL PATCH	L	1.00	Slabs

Sample Number: 013

Sample Type: A
Sample PCI: 80
Sample Area (Slabs): 22.00

Sample Comments:

63 LINEAR CRACKING	M	2.00	Slabs
67 LARGE PATCH	L	1.00	Slabs

Branch - Section ID: T01OE - 002

Branch Name: TAXIWAY 01 Use: TAXIWAY

LCD: 9/22/2018
Surface Type: AC
Rank: P
Section Area (sf): 43,163.00
Length (ft): 825.00
Width (ft): 35.00
From: T01OE-01
To: R13OE-01

PCI Family: IowaACTWNCE

Slabs:
Slab Length (ft):
Slab Width (ft):
Joint Length (ft):

Section Comments:

Last Insp Date: 11/13/2022
PCI: 92
Total Samples: 9
Surveyed: 4

Inspection Comments:

Sample Number: 01

Sample Type: R
Sample PCI: 95
Sample Area (SF): 4,600.00

Sample Comments:

57 WEATHERING	L	2,300.00	SF	

Sample Number: 03

Sample Type: R
Sample PCI: 93
Sample Area (SF): 4,850.00

Sample Comments:

48 LONGITUDINAL/TRANSVERSE CRACKING	L	3.00	Ft	LU
57 WEATHERING	L	2,400.00	SF	

Sample Number: 05

Sample Type: R
Sample PCI: 90
Sample Area (SF): 4,430.00

Sample Comments:

48 LONGITUDINAL/TRANSVERSE CRACKING	L	52.00	Ft	LU
57 WEATHERING	L	2,215.00	SF	

Sample Number: 07

Sample Type: R
Sample PCI: 89
Sample Area (SF): 4,375.00

Sample Comments:

48 LONGITUDINAL/TRANSVERSE CRACKING	L	67.00	Ft	LU
57 WEATHERING	L	2,200.00	SF	

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: TH01OE - 001

Branch Name: T-HANGAR 01 Use: T-HANGAR

LCD: 6/1/2004
Surface Type: AC
Rank: P
Section Area (sf): 8,858.00
Length (ft): 340.00
Width (ft): 25.00
From: .
To: .

PCI Family: IowaASPHALTTHNorthern

Slabs:
Slab Length (ft):
Slab Width (ft):
Joint Length (ft):

Section Comments:

Last Insp Date: 11/13/2022
PCI: 60
Total Samples: 2
Surveyed: 2

Inspection Comments:

Sample Number: 01

Sample Type: R
Sample PCI: 42
Sample Area (SF): 3,625.00

Sample Comments:

41 ALLIGATOR CRACKING	M	30.00	SF	
43 BLOCK CRACKING	L	300.00	SF	LU
48 LONGITUDINAL/TRANSVERSE CRACKING	L	150.00	Ft	LU
48 LONGITUDINAL/TRANSVERSE CRACKING	M	325.00	Ft	W
57 WEATHERING	M	3,625.00	SF	

Sample Number: 02

Sample Type: R
Sample PCI: 72
Sample Area (SF): 5,233.00

Sample Comments:

48 LONGITUDINAL/TRANSVERSE CRACKING	M	135.00	Ft	W
57 WEATHERING	L	3,233.00	SF	
57 WEATHERING	M	2,000.00	SF	

Branch - Section ID: TH01OE - 002

Branch Name: T-HANGAR 01 Use: T-HANGAR

LCD: 1/1/1994
Surface Type: AC
Rank: P
Section Area (sf): 8,660.00
Length (ft): 433.00
Width (ft): 20.00
From: .
To: .

PCI Family: IowaASPHALTTHNorthern

Slabs:
Slab Length (ft):
Slab Width (ft):
Joint Length (ft):

Section Comments:

Last Insp Date: 11/13/2022
PCI: 41
Total Samples: 2
Surveyed: 2

Inspection Comments:

Sample Number: 01

Sample Type: R
Sample PCI: 42
Sample Area (SF): 4,660.00

Sample Comments:

41 ALLIGATOR CRACKING	L	180.00	SF	EDGE
45 DEPRESSION	H	3.00	SF	
48 LONGITUDINAL/TRANSVERSE CRACKING	L	68.00	Ft	LU
48 LONGITUDINAL/TRANSVERSE CRACKING	M	200.00	Ft	W 2NDY
53 RUTTING	L	30.00	SF	
57 WEATHERING	M	4,660.00	SF	

Sample Number: 02

Sample Type: R
Sample PCI: 39
Sample Area (SF): 4,000.00

Sample Comments:

41 ALLIGATOR CRACKING	M	100.00	SF	
48 LONGITUDINAL/TRANSVERSE CRACKING	L	148.00	Ft	LU
48 LONGITUDINAL/TRANSVERSE CRACKING	M	180.00	Ft	W
50 PATCHING	H	80.00	SF	
57 WEATHERING	M	3,920.00	SF	

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: TH01OE - 003

Branch Name: T-HANGAR 01 Use: T-HANGAR

LCD: 6/1/1994
Surface Type: AC
Rank: P
Section Area (sf): 7,044.00
Length (ft): 300.00
Width (ft): 20.00
From: .
To: .

PCI Family: IowaASPHALTTHNorthern

Slabs:
Slab Length (ft):
Slab Width (ft):
Joint Length (ft):

Section Comments:

Last Insp Date: 11/13/2022
PCI: 47
Total Samples: 2
Surveyed: 2

Inspection Comments:

Sample Number: 01

Sample Type: R
Sample PCI: 43
Sample Area (SF): 3,995.00

Sample Comments:

41 ALLIGATOR CRACKING	M	10.00	SF
43 BLOCK CRACKING	L	1,500.00	SF
48 LONGITUDINAL/TRANSVERSE CRACKING	L	100.00	Ft
48 LONGITUDINAL/TRANSVERSE CRACKING	M	350.00	Ft
57 WEATHERING	M	3,995.00	SF

Sample Number: 02

Sample Type: R
Sample PCI: 53
Sample Area (SF): 3,049.00

Sample Comments:

41 ALLIGATOR CRACKING	M	20.00	SF
48 LONGITUDINAL/TRANSVERSE CRACKING	L	78.00	Ft
48 LONGITUDINAL/TRANSVERSE CRACKING	M	150.00	Ft
57 WEATHERING	M	3,049.00	SF

RE-INSPECTION REPORT
OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: TH01OE - 004

Branch Name: T-HANGAR 01 Use: T-HANGAR

LCD: 11/1/2008
Surface Type: PCC
Rank: P
Section Area (sf): 8,315.00
Length (ft): 310.00
Width (ft): 24.00
From: .
To: .

PCI Family: IowaPCCTH NE NCE

Slabs: 58
Slab Length (ft): 12.00
Slab Width (ft): 12.00
Joint Length (ft): 1,012.55

Section Comments:

Last Insp Date: 11/13/2022
PCI: 66
Total Samples: 3
Surveyed: 3

Inspection Comments:

Sample Number: 01

Sample Type: R
Sample PCI: 78
Sample Area (Slabs): 26.00

Sample Comments:

63 LINEAR CRACKING	L	4.00	Slabs
65 JOINT SEAL DAMAGE	H	26.00	Slabs
75 CORNER SPALL	M	1.00	Slabs

Sample Number: 02

Sample Type: R
Sample PCI: 60
Sample Area (Slabs): 16.00

Sample Comments:

63 LINEAR CRACKING	L	1.00	Slabs
63 LINEAR CRACKING	M	4.00	Slabs
65 JOINT SEAL DAMAGE	H	16.00	Slabs

Sample Number: 03

Sample Type: R
Sample PCI: 51
Sample Area (Slabs): 16.00

Sample Comments:

62 CORNER BREAK	M	2.00	Slabs
63 LINEAR CRACKING	M	5.00	Slabs
65 JOINT SEAL DAMAGE	H	16.00	Slabs

APPENDIX D

WORK HISTORY REPORT

WORK HISTORY

Pavement Database: IA 2022
Network ID: OLZ

Generate Date: 6/25/2023

Network: OELWEIN MUNICIPAL AIRPORT

Branch - Section ID: A01OE - 001

LCD: 6/1/1993
Use: APRON
Rank: P
Surface: PCC

Length (ft): 260.00
Width (ft): 170.00
True Area (sf): 46,442.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
11-12-2022	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	-
11-11-2022	PA-PP	Patching - PCC Partial Depth	$0.00	0.00	False	-
11-10-2022	SL-PC	Slab Replacement - PCC	$0.00	0.00	False	-
06-01-2007	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	-
06-01-1993	NC-PC	New Construction - PCC	$0.00	0.00	True	-

Branch - Section ID: R13OE - 001

LCD: 6/1/1993
Use: RUNWAY
Rank: P
Surface: PCC

Length (ft): 4,001.00
Width (ft): 75.00
True Area (sf): 314,028.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
11-12-2022	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	EST
11-11-2022	PA-PP	Patching - PCC Partial Depth	$0.00	0.00	False	EST
06-01-2007	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	-
06-01-1993	CR-PC	Complete Reconstruction - PCC	$0.00	0.00	True	-
06-03-1962	NC-AC	New Construction - AC	$0.00	2.00	True	2" P-401
06-02-1962	BA-BI	Base Course - Bituminous	$0.00	2.00	False	2" P-201
06-01-1962	BA-AG	Base Course - Aggregate	$0.00	8.00	False	8" P-209

Branch - Section ID: T01OE - 001

LCD: 6/1/1993
Use: TAXIWAY
Rank: P
Surface: PCC

Length (ft): 910.00
Width (ft): 40.00
True Area (sf): 37,130.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
11-12-2022	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	-
11-11-2022	PA-PP	Patching - PCC Partial Depth	$0.00	0.00	False	EST
06-01-2007	JS-LC	Joint Seal (Localized)	$0.00	0.00	False	-
06-01-1993	NC-PC	New Construction - PCC	$0.00	0.00	True	-

Branch - Section ID: T01OE - 002

LCD: 9/22/2018
Use: TAXIWAY
Rank: P
Surface: AC

Length (ft): 825.00
Width (ft): 35.00
True Area (sf): 43,163.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
09-22-2018	NU-IN	New Construction - Initial	$0.00	4.00	True	4" P-403 HMA
09-21-2018	BA-AG	Base Course - Aggregate	$0.00	6.00	False	6" P-208 CAB
09-20-2018	SB-AG	Subbase - Aggregate	$0.00	4.00	False	4" P-154 Subbase Course

WORK HISTORY

Pavement Database: IA 2022
Network ID: OLZ

Generate Date: 6/25/2023

Branch - Section ID: TH01OE - 001

LCD: 6/1/2004
Use: T-HANGAR
Rank: P
Surface: AC

Length (ft): 340.00
Width (ft): 25.00
True Area (sf): 8,858.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
06-01-2004	NU-IN	New Construction - Initial	$0.00	0.00	True	EST

Branch - Section ID: TH01OE - 002

LCD: 1/1/1994
Use: T-HANGAR
Rank: P
Surface: AC

Length (ft): 433.00
Width (ft): 20.00
True Area (sf): 8,660.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
01-01-1994	NU-IN	New Construction - Initial	$0.00	0.00	True	UNKNOWN, PRE 1994

Branch - Section ID: TH01OE - 003

LCD: 6/1/1994
Use: T-HANGAR
Rank: P
Surface: AC

Length (ft): 300.00
Width (ft): 20.00
True Area (sf): 7,044.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
06-01-1994	NU-IN	New Construction - Initial	$0.00	0.00	True	UNKNOWN, PRE 1994

Branch - Section ID: TH01OE - 004

LCD: 11/1/2008
Use: T-HANGAR
Rank: P
Surface: PCC

Length (ft): 310.00
Width (ft): 24.00
True Area (sf): 8,315.00

Work Date	Work Code	Work Description	Cost	Thickness (in)	Major MR	Comments
11-01-2008	NU-IN	New Construction - Initial	$0.00	0.00	True	.

APPENDIX E

LOCALIZED PREVENTIVE MAINTENANCE POLICIES AND UNIT COST TABLES

Table E-1. Localized preventive maintenance policy, asphalt-surfaced pavements.

Distress Type	Severity Level	Maintenance Action
Alligator Cracking	Low	Monitor
Alligator Cracking	Medium	Asphalt Patch
Alligator Cracking	High	Asphalt Patch
Bleeding	N/A	Monitor
Block Cracking	Low	Monitor
Block Cracking	Medium	Crack Seal—Asphalt
Block Cracking	High	Crack Seal—Asphalt
Corrugation	Low	Monitor
Corrugation	Medium	Asphalt Patch
Corrugation	High	Asphalt Patch
Depression	Low	Monitor
Depression	Medium	Monitor
Depression	High	Asphalt Patch
Jet-Blast Erosion	N/A	Asphalt Patch
Joint Reflection Cracking	Low	Monitor
Joint Reflection Cracking	Medium	Crack Seal—Asphalt
Joint Reflection Cracking	High	Crack Seal—Asphalt
L&T Cracking	Low	Monitor
L&T Cracking	Medium	Crack Seal—Asphalt
L&T Cracking	High	Crack Seal—Asphalt
Oil Spillage	N/A	Asphalt Patch
Patching	Low	Monitor
Patching	Medium	Asphalt Patch
Patching	High	Asphalt Patch
Polished Aggregate	N/A	Monitor
Raveling	Low	Monitor
Raveling	Medium	Asphalt Patch
Raveling	High	Asphalt Patch
Rutting	Low	Monitor
Rutting	Medium	Monitor
Rutting	High	Asphalt Patch
Shoving	Low	Monitor
Shoving	Medium	Asphalt Patch
Shoving	High	Asphalt Patch
Slippage Cracking	N/A	Asphalt Patch
Swelling	Low	Monitor
Swelling	Medium	Monitor
Swelling	High	Asphalt Patch
Weathering	Low	Monitor
Weathering	Medium	Monitor
Weathering	High	Asphalt Patch

Table E-2. Localized preventive maintenance policy, PCC pavements.

Distress Type	Severity Level	Maintenance Action
ASR	Low	Monitor
ASR	Medium	Slab Replacement
ASR	High	Slab Replacement
Blowup	Low	Slab Replacement
Blowup	Medium	Slab Replacement
Blowup	High	Slab Replacement
Corner Break	Low	Crack Seal—PCC
Corner Break	Medium	Full Depth PCC Patch
Corner Break	High	Full Depth PCC Patch
Durability Cracking	Low	Monitor
Durability Cracking	Medium	Full Depth Patch
Durability Cracking	High	Slab Replacement
Faulting	Low	Monitor
Faulting	Medium	Grinding
Faulting	High	Slab Replacement
Joint Seal Damage	Low	Monitor
Joint Seal Damage	Medium	Joint Seal
Joint Seal Damage	High	Joint Seal
LTD Cracking	Low	Monitor
LTD Cracking	Medium	Crack Seal—PCC
LTD Cracking	High	Slab Replacement
Patching (Small and Large)	Low	Monitor
Patching (Small and Large)	Medium	Full Depth PCC Patch
Patching (Small and Large)	High	Full Depth PCC Patch
Popouts	N/A	Monitor
Pumping	N/A	Monitor
Scaling	Low	Monitor
Scaling	Medium	Partial Depth PCC Patch
Scaling	High	Slab Replacement
Shattered Slab	Low	Crack Seal—PCC
Shattered Slab	Medium	Slab Replacement
Shattered Slab	High	Slab Replacement
Shrinkage Cracking	N/A	Monitor
Spalling (Joint and Corner)	Low	Monitor
Spalling (Joint and Corner)	Medium	Partial Depth PCC Patch
Spalling (Joint and Corner)	High	Partial Depth PCC Patch

Table E-3. 2023 unit costs for localized preventive maintenance actions.

Maintenance Action	Unit Cost
Asphalt Patch—Asphalt-Surfaced Pavement	$15.24/sf
Crack Sealing—Asphalt-Surfaced Pavement	$2.61/lf
Partial Depth PCC Patch—PCC Pavement	$39.04/sf
Full Depth PCC Patch—PCC Pavement	$17.43/sf
Crack Sealing—PCC Pavement	$3.14/lf
Joint Sealing—PCC Pavement	$3.14/lf
Grinding—PCC Pavement	$0.37/sf
Slab Replacement—PCC Pavement	$17.43/sf

Table Note: The unit cost estimates are based on broad statewide numbers and should be adjusted to reflect local costs.

Table E-4. 2023 unit costs (per square foot) based on pavement type and PCI ranges.

Pavement Type	PCI Range 0–40	PCI Range 40–50	PCI Range 50–60	PCI Range 60–70	PCI Range 70–80	PCI Range 80–90	PCI Range 90–100
AC	$10.82	$5.12	$5.12	$5.12	$0.00	$0.00	$0.00
PCC	$18.08	$8.55	$8.55	$8.55	$0.00	$0.00	$0.00

Table Note: The unit cost estimates are based on broad statewide numbers and should be adjusted to reflect local costs.

APPENDIX F

YEAR 2023 LOCALIZED PREVENTIVE MAINTENANCE DETAILS

Table F-1. Year 2023 localized preventive maintenance details.

Branch	Section	Distress Type	Severity	Distress Quantity	Distress Unit	Maintenance Action	Unit Cost	2023 Estimated Cost
A01OE	01	Corner Break	Medium	3	Slabs	Patching - PCC Full Depth	$17.43	$1,534
A01OE	01	LTD Cracking	Medium	22	Slabs	Crack Sealing - PCC	$3.14	$685
T01OE	01	Corner Spalling	High	4	Slabs	Patching - PCC Partial Depth	$39.04	$401
T01OE	01	LTD Cracking	Medium	6	Slabs	Crack Sealing - PCC	$3.14	$206
TH01OE	04	Corner Break	Medium	2	Slabs	Patching - PCC Full Depth	$17.43	$1,126
TH01OE	04	Corner Spalling	Medium	1	Slabs	Patching - PCC Partial Depth	$39.04	$105
TH01OE	04	Joint Seal Damage	High	58	Slabs	Joint Seal (Localized)	$3.14	$3,179
TH01OE	04	LTD Cracking	Medium	9	Slabs	Crack Sealing - PCC	$3.14	$339

Table Notes:

1. See Figure 3 for the location of the branch and section.
2. Distress types are defined by ASTM D5340-20. L&T Cracking = Longitudinal and Transverse Cracking; LTD Cracking = Longitudinal, Transverse, and Diagonal Cracking; ASR = Alkali-Silica Reaction.
3. The costs provided are of a general nature for the entire state and may require adjustment to reflect specific conditions at Oelwein Municipal Airport.

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