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New Jersey 08405

In-Service Performance of Concrete Airport Pavements Constructed Using State Highway Specifications

September 2024

Final Report

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16. Abstract

The Federal Aviation Administration (FAA) Reauthorization Act of 2018, Section 136 requires the FAA to allow the use of state highway specifications for airfield pavement construction at non-primary airports serving aircraft with a gross weight less than 60,000 lb if requested by the state. To confirm that state highway specifications provide an acceptable level of performance when used on airport pavements, the FAA initiated this study to compare the performance of airports constructed using state highway specifications with those constructed using FAA specifications. Performance data and specifications from 51 projects at 15 airports in Iowa and Missouri were analyzed, with 23 using FAA specifications and 28 using state highway specifications. Based on the summarized pavement condition index (PCI) ratings from those projects (which are based on visual condition surveys and do not consider structural or functional performance), it was determined that the performance of airport concrete pavements varies based on age, location, and specification, but the effects of the individual factors was not explained well. The projects used in this study skewed to a young age and good overall performance, which may not reflect the long-term performance of these pavements. There were no significant differences in load-related distresses or climate-related distresses between the FAA and state specification projects. The good performance of projects constructed with state specifications may reflect that knowledge gleaned from the local performance of highway concrete pavements has been incorporated into the specifications used for airfield concrete pavements.

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LIST OF SYMBOLS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	Advisory Circular
ADIP	Airport Data and Information Portal
AGE	Age at survey
AIP	Airport Improvement Program
AMW	Ames Municipal Airport
ANOVA	Analysis of variance
APMS	Airport pavement management system
APTech	Applied Pavement Technology, Inc.
ASR	Alkali-silica reaction
BLOC	Binary variable location
BNW	Boone Municipal Airport
BSPC	Binary variable specification
CaO	Calcium oxide
CF	Coarseness factor
d-cracking	Durability cracking
df	Degrees of Freedom
DMO	Sedalia Regional Airport
DOT	Department of Transportation
EB	Engineering Brief
EBS	Webster City Municipal Airport
EFW	Jefferson Municipal Airport
F	Ratio of Explained Variance to Unexplained Variance
FAA	Federal Aviation Administration
FOD	Fort Dodge Regional Airport
FWB	Branson West Municipal-Emerson Field
GA	General aviation
GGBFS	Ground granulated blast-furnace slag
H79	Eldon Model Airpark
ha	Hectares
HAE	Hannibal Regional Airport
IaDOT	Iowa Department of Transportation
IM	Instructional Memorandum
K89	Macon-Fower Memorial
LLU	Lamar Municipal Airport
LXT	Lee’s Summit Municipal Airport
MBY	Omar N. Bradley Airport
ME	Mechanistic-empirical
MoDOT	Missouri Department of Transportation
MPZ	Mount Pleasant Municipal Airport
MS	Mean Square
NPIAS	National Plan of Integrated Airport Systems
NVD	Nevada Municipal Airport
PCC	Portland cement concrete (rigid)
PCI	Pavement condition index

PCN	Pavement classification number
PWL	Percentage of material within limit
QA	Quality assurance
QC	Quality control
QM-C	Quality management concrete
RW	Runway
Sp. Gr.	Specific gravity
SS	Sum of squares
TM	Test Method
TSPWG	Tri-Service Pavements Working Group
TW	Taxiway
w/c	Water-to-cement ratio
WF	Workability factor

EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) Reauthorization Act of 2018, Section 136, requires the FAA to allow the use of state highway specifications for airfield pavement construction at non-primary airports serving aircraft with a gross weight of less than 60,000 lb. The FAA may allow a substitution of state highway specifications to be used for airfield pavement construction if it is requested by the state, safety will not be negatively impacted, and the life of the pavement will not be shorter than if constructed using FAA specifications. While this is relatively new legislation, the FAA has permitted the use of state highway specifications for the construction of airports (under certain conditions) since 1977.

There are significant differences in loads, tire pressures, and types of loading between highways and airports, and highway specifications were not developed considering those differences. Therefore, the FAA initiated this study to evaluate the performance of previously constructed airport rigid pavements that used highway specifications and to compare their performance to those constructed using FAA specifications. The overall purpose was to determine if state highway materials and construction requirements for rigid pavements can perform satisfactorily at non-primary, public-use airports serving aircraft less than 60,000-lb gross weight.

In addition to the above-noted primary objective of this study, another goal was to identify differences in material requirements in state highway specifications compared to FAA standard specifications for rigid pavement materials. To accomplish these objectives, the research team identified states where there were sufficient pavement condition data to compare performance between pavements constructed with the two types of specifications, analyzed the data, and identified factors that affected whether a substitution could be made.

After consideration of available information from nine states, performance data and construction information were obtained from 51 projects from two states (Iowa and Missouri). Of those 51 projects, 28 used state highway specifications and 23 used FAA specifications. Pavement condition index (PCI) ratings obtained at different times following construction were then compiled and summarized for each of the projects as a function of age (years after reconstruction/rehabilitation).

Because of the differences between highway and airport pavements, construction requirements for airport pavement projects can be quite different than those of highway pavement projects. To identify significant differences between the two types of specifications, state rigid pavement specifications (which were used for the airfield projects documented in this report) and FAA rigid pavement specifications were compared. State specifications were similar to the FAA P-501 specification but had some differences. The specification comparisons focused on the following: aggregates, cement and cementitious materials, admixtures, concrete mix and mix design, quality control, acceptance, and construction.

Based on the information compiled during this project, the following conclusions were drawn:

- There is a statistically significant difference in performance based on age, location (state), and specification used, although the regression model in the analysis did not explain the variability in the performance results.
- Neither the FAA nor state specifications contributed to a significant difference in load-related distress. Without correcting for factors known to impact load-carrying capabilities (including location, applied loads, pavement age, pavement branch), state specifications performed as well as FAA specifications in controlling load-related distresses.
- Distresses with climate as the contributing cause showed up frequently for both FAA and state specification projects. This category includes both materials distresses, such as alkali-silica reaction (ASR) and durability cracking (d-cracking), and joint seal damage. Joint seal damage was a frequently recorded distress, but neither ASR nor d-cracking were prevalent.
- At airports where head-to-head performance comparisons between FAA and state specifications could be made (again without further consideration of other variables affecting performance), state specification projects consistently performed at least as well as FAA specification projects. In some cases, state specifications may actually be more stringent than FAA specifications, especially with respect to screening for and mitigating known material performance problems.
- All of the projects were relatively new for concrete pavements (mean age at most recent survey less than 10 years) and in good condition (mean PCI greater than 90). This created challenges in discerning meaningful differences in performance for pavements constructed with the different specifications.
- In considering projects in only two states, broader conclusions about projects constructed with state and FAA specifications may not be extrapolated from the presented data. In particular, it is possible that the good performance of state specifications may reflect the experience of those specific states in improving their highway concrete specifications to the point where they contribute to good overall performance on airfield pavements. It is reasonable to suppose that agencies with many years of experience constructing highway pavements of concrete would have evolved specifications that would work well for airfield pavements, but that topic was not explored under this project. IPRF Project 01-G-002-05-3, *Review of State Highway Materials for Concrete Airfield Pavement Construction* (Van Dam et al., 2010) provides a closer, albeit slightly dated, look at specifications for 48 states.

1. INTRODUCTION

Rigid pavement surfaces placed over stabilized or granular bases and subbases are commonly used on both airfields and highways. However, there are differences in how airfield and highway pavements are designed, loaded, and maintained, as well as differences in how they perform. Some of these differences are summarized in the following sections.

1.1 DESIGN

Highway pavements are commonly designed based on either American Association of State Highway and Transportation Officials (AASHTO) procedures (such as the mechanistic-empirical (ME) Design procedure) or a state-specific procedure, while airfield pavement projects "funded under Federal grant assistance programs, including the Airport Improvement Program (AIP)" must use FAA Advisory Circular (AC)150/5320-6G, *Airport Pavement Design and Evaluation* (FAA, 2021) and FAARFIELD, the FAA's ME design procedure.

1.2 LOADING

1.2.1 Volume

Frequently used airfield pavements may only experience several hundred daily load applications, while frequently traveled roadway pavements can experience over 100,000 daily loads.

1.2.2 Loading

The typical heavy highway load is 80,000 lb, while the heaviest loaded aircraft apply loads of over 1,000,000 lb.

1.2.3 Tire Pressure

On highway vehicles typical tire pressures range from 35 (psi) to 125 psi, while aircraft tire pressures may go as high as 250 psi.

1.2.4 Gear Configuration

With the exception of specialty trucks designed to carry extremely heavy loads, the majority of highway vehicles have single axles, dual axles, dual-tandem axles, and triple axles. The greatest portion of an aircraft's load is applied through the landing gear axles, which are designed to distribute load and come in many different configurations depending on the aircraft and its load.

1.2.5 Loading Location

While aircraft land with their nose gear approximately on the runway centerline and use the same positioning when traveling along a taxiway or apron, actual aircraft wander (i.e., the deviation from the nose gear on the centerline) varies depending on the aircraft. Highway traffic follows more of a defined wheel path between pavement edge markings.

1.3 PERFORMANCE AND MAINTENANCE

While highway users may prefer smooth roads with minimal defects, acceptable conditions are defined in different ways and vary among state DOTs. Airfield pavements are designed and constructed "to produce a surface that is: firm, stable, smooth, skid resistant, year-round all-weather surface, free of debris or other particles that can be blown or picked up by propeller wash or jet blast" (FAA, 2021). A significant difference between operating requirements for highways and airfield pavements is that the quantity and severity of tolerable defects is much smaller for airfields than for roadways.

Although there are many similarities between highway and airfield pavements, differences in the traffic they carry and in the impact of performance deficiencies on operations in general, and safety in particular, have contributed to different requirements for both design and materials. As noted, on airfield pavements there is a lower tolerance for distresses that cause roughness (e.g., settlement/faulting, and any distress that would contribute to foreign object debris, such as scaling, spalling, popouts, sealant damage, alkali-silica reaction (ASR), and durability cracking). Airfield pavements must also provide adequate profile and texture for aircraft to operate safely.

FAA AC 150/5320-6G provides the requirements for airfield pavement design with the assumption that P-501 materials are used for rigid pavement design procedure (FAA, 2021). However, the FAA Reauthorization Act of 2018 Section 136 (2018) requires the FAA to allow the use of highway materials specifications for pavements at non-primary airports serving aircraft weighing less than 60,000 pounds when requested by the state. This is addressed in Item P-501, Cement Concrete Pavement (CCP), in FAA AC 150/5370-10H, *Standard Specifications for Construction of Airports* (FAA, 2020), as follows:

> This specification is to be used for the surface course for airfield rigid pavements subject to aircraft loadings greater than 30,000 pounds. For airfield pavement projects at non primary airports, serving aircraft less than 60,000 pounds, state highway specifications may be used in states where the state has requested and received FAA approval to use state highway specifications.
>
> State highway department material specifications may be used for access roads, perimeter roads, and other pavements subject to aircraft loading less than or equal to 30,000 pounds.
> When state highway material specifications are used, include all applicable/approved state specifications in the contract documents. State specifications must include the material requirements of paragraph 501-2.1 for reactivity.

The FAA's P-501 specification may differ substantively from the state concrete material specifications that are allowed for construction of airfield pavements under the above-noted conditions. In addition to requiring testing for aggregate reactivity as discussed in P-501-2.1 (FAA, 2020), the FAA specifications are prescriptive for many aspects of concrete pavement materials and handling. P-501 also calls for quality control (QC) and quality assurance (QA) testing and has airfield-specific smoothness requirements, while state QA procedures and smoothness requirements are potentially different from FAA requirements.

Both the FAA's pavement design procedure and its concrete materials specifications have evolved over many years based on knowledge gained from widespread observations of the performance of in-service airfield pavements and specific studies completed at the FAA William J. Hughes Technical Center in Atlantic City, New Jersey. Because there are differences in loads, tire pressures, and types of loading between highways and airports, and because highway specifications for concrete pavements were not developed considering those differences, the FAA authorized an evaluation of the in-service performance of airport pavements previously constructed using highway specifications. A review of the in-service performance data of those pavements compared to airport pavements constructed using FAA standard specifications could determine if state highway concrete materials and construction requirements can perform satisfactorily at non-primary public-use airports serving aircraft less than 60,000-lb gross weight.

2. OBJECTIVE AND SCOPE

The two primary objectives of this project are to: (1) document and compare the in-service performance of concrete pavements constructed following state highway specifications to the performance of concrete pavements constructed following FAA standard specifications for aircraft less than 60,000 pounds, and (2) identify differences in material requirements in state highway specifications versus FAA standard specifications for rigid (cement concrete) pavement materials.

To accomplish the objectives of this study, the research team collected pavement performance data and other data regarding pavement designs and analyzed and presented the results. The team also compared current concrete pavement specifications from two states to FAA P-501 specifications.

3. METHODOLOGY

Applied Pavement Technology, Inc. (APTech) reviewed airport pavement management system (APMS) databases from the following nine states known to construct concrete airfield pavements:

- Arizona
- Georgia
- Illinois
- Indiana
- Iowa
- Massachusetts
- Missouri
- Washington
- Wisconsin

The goal of this review was to identify a minimum of 30 Portland cement concrete (PCC)-surfaced general aviation (GA) runways, taxiways, and aprons that had been constructed with state specifications and had yet to be rehabilitated (i.e., they still had their original concrete surface). Two additional criteria were used to identify candidate pavements: (1) collocation with

PCC pavements constructed using FAA specifications, and (2) availability of sufficient condition data to draw conclusions regarding pavement performance.

Potential projects were identified by sorting through state APMS databases based on appropriate criteria. The APMS database search parameters included the pavement type, pavement age, number of PCI surveys that had been performed, and the PCC specification that was used in the construction of the pavement. If the PCC specification was not an FAA P-501, this was identified in the database comments.

The search for airfield pavements constructed using state specification concrete resulted in no candidate pavement sections in Arizona, Illinois, Massachusetts, or Washington. Among Georgia, Indiana, and Wisconsin, only one potential candidate was identified. As shown in Table 1, 30 candidates were identified in Iowa and Missouri. These pavement candidates range in age from five to 21 years and performance data in the form of distress summaries, and PCI ratings are available for at least three survey cycles in all but one instance at Lee's Summit Municipal Airport.

Table 1. Airport Sections Constructed with State Specifications

State	Airport	Branch and Section ID*	Age, Years	Number of PCI Inspections
Iowa	Jefferson Municipal	R14JE-01	21	7
		R14JE-02	21	6
	Mount Pleasant Municipal	A02MP-02	18	5
	Webster City Municipal	R14WC-01	21	6
		T01WC-02	20	6
Missouri	Eldon Model Airport	RW1836EL-20	12	3
		TWAEL-20	12	3
	Lamar Municipal	AHOLD35LA-10	9	3
		AHOLD3LA-10	9	3
		RW0321LA-20	9	3
		RW1735LA-10	9	3
		TWALA-20	9	3
	Lee's Summit Municipal	AEASTLS-10	12	3
		RW1836LS-10	5	1
		TWCLS-10	12	3
	Macon-Fower Memorial	RW0220MC-10	9	3
		TWAMC-10	9	3
		TWAMC-20	9	3
	Sedalia Regional	RW1836SE-10	8	3
		TWASE-20	8	3
	Branson West Municipal-Emerson	A01BW-10	13	3
		A02BW-10	13	3
		A03BW-10	13	3
		RW0321BW-10	13	3
		TH01BW-10	13	3
		TWABW-10	13	3
		TWDBW-10	13	3
	Omar N. Bradley	TWAMB-10	10	3

*The source of the Branch and Section identifiers is the respective state's Airfield Pavement Management database.

Many of the identified pavement sections constructed using state specifications are at airports where there are also sections constructed following the FAA P-501 specification.

4. PROJECT SUMMARIES

To assess the overall performance of each airfield and determine any relationship between design, specifications, and materials and overall performance, project records were reviewed using the Iowa and Missouri state APMS databases, and performance data were summarized and analyzed. The emphasis in these summaries is on the PCI, which is an overall rating on a scale of 0 to 100 that is developed from visual inspection and measurement of the distresses identified in ASTM D5340, *Standard Test Method for Airport Pavement Condition Index Surveys* (ASTM, 2018). In the PCI survey, pavements are identified as branches (e.g., runways, taxiways, and aprons), sections (contiguous subsets of branches sharing common design, construction, trafficking, and performance elements), and sample units (a subdivision of a section which, for concrete pavements, consists of 20 ± 8 contiguous slabs). Distress surveys for each section are performed on a statistically representative number of sample units, and the results are combined to report an overall PCI.

A brief summary of the projects at each airport in Iowa and Missouri follows. Each summary includes graphs of performance (PCI) over time, where appropriate, modeled in most cases by a best-fit polynomial curve. For clarity, these graphs identify by an (F) or an (S) whether the section was constructed following FAA or state specifications. A more detailed summary of each project, including the distress types, severity levels, and quantities, is available in Appendix A. Detailed PCI results are available in Appendix B.

4.1 IOWA

4.1.1 Boone Municipal Airport

Boone Municipal Airport (BNW) is a GA airport located 2 miles southeast of Boone, in Boone County, Iowa. Runway 15/33 was resurfaced in 2007 using FAA specifications. Work consisted of a 6-in. surface placed over a 6-in. subbase. Aircraft operations in 2021 totaled 18,000 aircraft annually. Runway 15/33 has a load rating of a Single Wheel—30,000 lb.

The most common distress on the runway was joint seal damage, with a few instances of linear cracking, faulting, and corner spall. The majority of the distress deducts were associated with climate. The 2022 PCI was 91 for Runway 15/33, and the PCI ratings since the most recent rehabilitation for Runway 15/33 are shown in Figure 1.

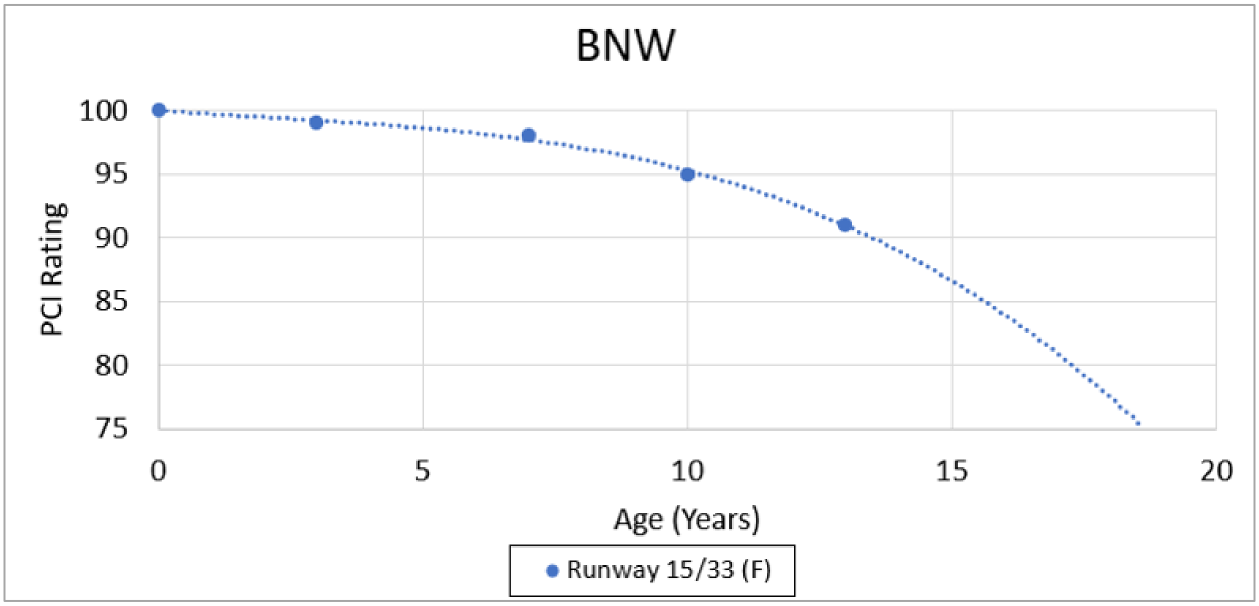


Figure 1. Boone Municipal Airport Runway 15/33 PCI Ratings

4.1.2 Mount Pleasant Municipal Airport

Mount Pleasant Municipal Airport (MPZ) is a GA airport located 3 miles southeast of Mount Pleasant, in Henry County, Iowa. Three sections of Apron 02 were selected for review because rehabilitation and new construction were conducted on these three sections using both FAA and state specifications. Rehabilitation of Section 01 was completed in 2010 using FAA specifications, new construction of Section 02 was completed in 2004 using state specifications, and new construction of Section 03 was completed in 2009 using FAA specifications.

Plans for Rehabilitation of Section 01 included removal of the existing pavement and repaving with 6 in of PCC; plans for the work to be completed on Sections 02 and 03 were not provided. Airport aircraft operations totaled 8,759 annually in 2021. The load ratings for the nearest rated pavement are for Runway 15/33: Single Wheel—12,000 lb, Dual Wheel—16,000 lb.

The 2020 PCIs for Apron 02 are as follows: Section 01 = 81, Section 02 = 80, and Section 03 = 88. The following distresses were identified on the various sections: joint seal damage, joint spalls, ASR, faulting, linear cracking, shattered slab, small patch, and corner spalls. Section 01 had a number of load-related distress deducts; but overall, most of the distresses were identified as caused by climate or other. The PCI ratings for the different sections on Apron 02 are shown in Figure 2.

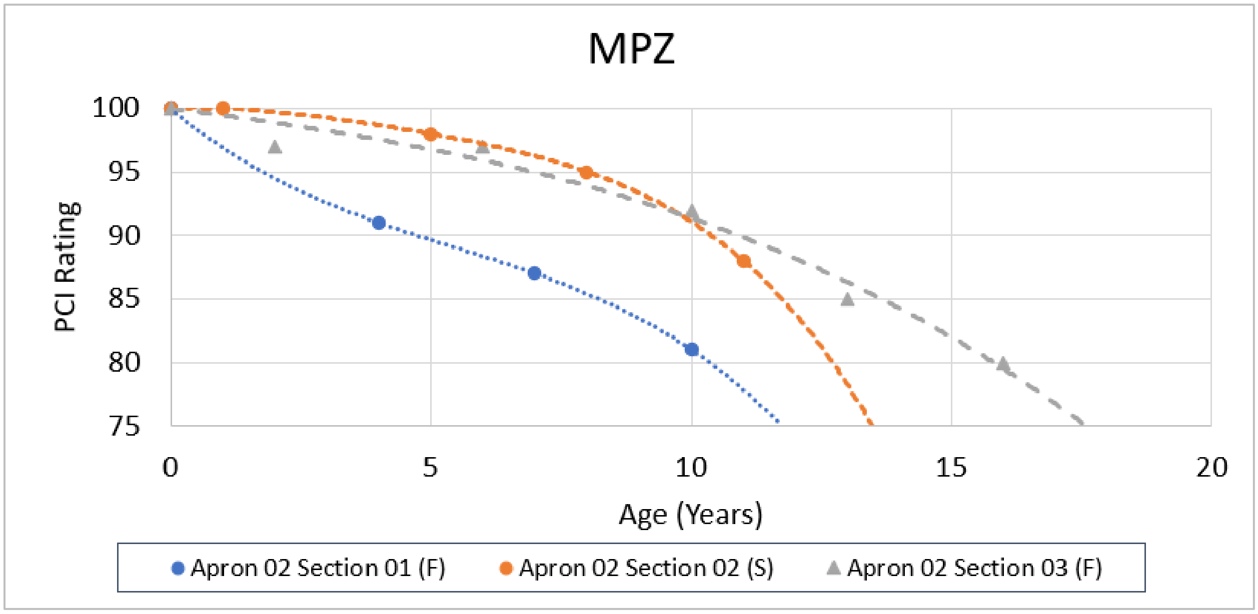


Figure 2. Mount Pleasant Municipal Airport Apron 02 PCI Ratings

4.1.3 Webster City Municipal Airport

Webster City Municipal Airport (EBS) is a GA airport located 3 miles southwest of Webster City, in Hamilton County, Iowa. Runways 14/32 and 05/23, and Taxiways 01, 03, and 04 at EBS were selected for review. Rehabilitation and new construction were completed on those areas between 2000 and 2002. New construction of Runway 05/23 was completed in 2000 using FAA specifications, a PCC overlay of Runway 14/32 was completed in 2001 using state specifications, an overlay of Taxiway 01 was completed in 2002 using state specifications, and new construction on Taxiways 03 and 04 was completed in 2002 using FAA state specifications. Plans for this work were not available. In 2021, aircraft operations at EBS totaled 3,250 aircraft annually. Runway 14/32 has the following load rating: Single Wheel—15,000 lb.

The following 2020 PCI data were recorded:

- Runway 14/32 = 89
- Runway 5/23 = 89
- Taxiway 01 = 92
- Taxiway 03 = 91
- Taxiway 04 = 91

The following distresses were identified: joint seal damage, joint spalling, faulting, linear cracking, and corner spalls. The predominant distress cause was climate, but Runway 5/23 exhibited load-related distresses contributing to 43 percent of the deducted points. The PCI ratings for each of these sections since their most recent construction are shown in Figure 3.

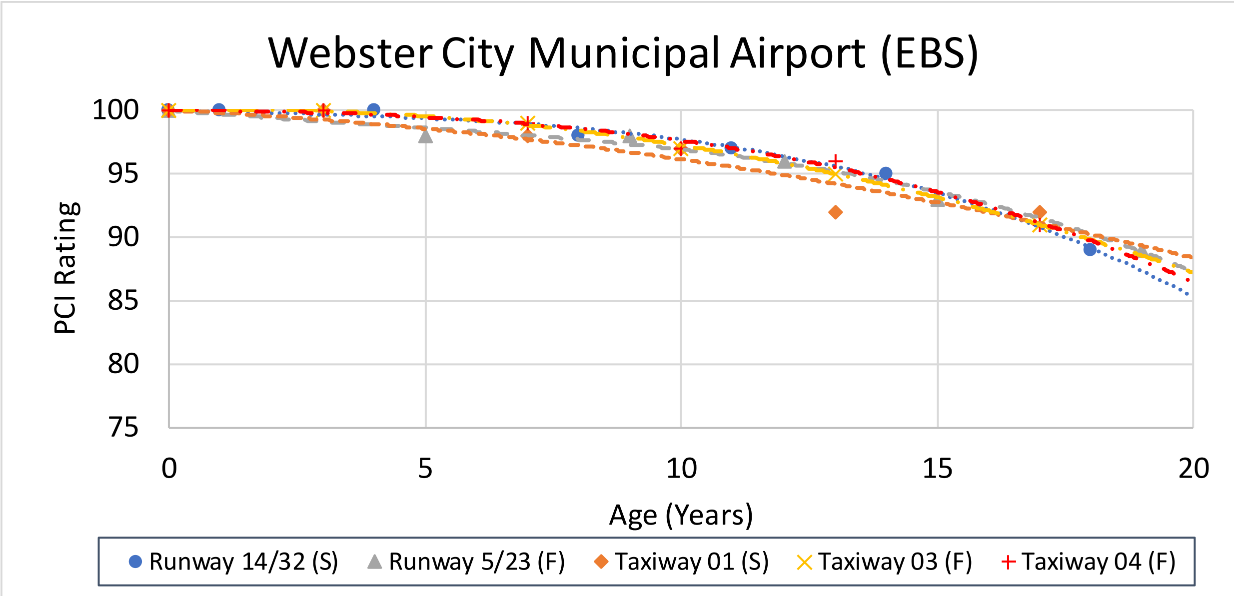


Figure 3. Webster City Municipal Airport PCI Ratings

4.1.4 James Herman Banning Ames Municipal Airport

James Herman Banning Ames Municipal Airport (AMW) is a GA airport located 2 miles southeast of Ames, in Story County, Iowa. Two sections of Runway 13/31, which was rehabilitated in 2009 using FAA specifications, were selected for review. The work included milling and removal of the existing pavement and paving with 6 in of new PCC. Annual operations as of 2021 are 37,751 aircraft. Runway 13/31 has the following load rating: Single Wheel—30,000 lb. The 2019 PCI for Runway 13/31 for sections 01 and 04 were 98 and 95, respectively, and the following distresses (primarily caused by climate) were identified: joint seal damage and faulting. A plot of the PCI ratings since the 2009 work is shown in Figure 4.

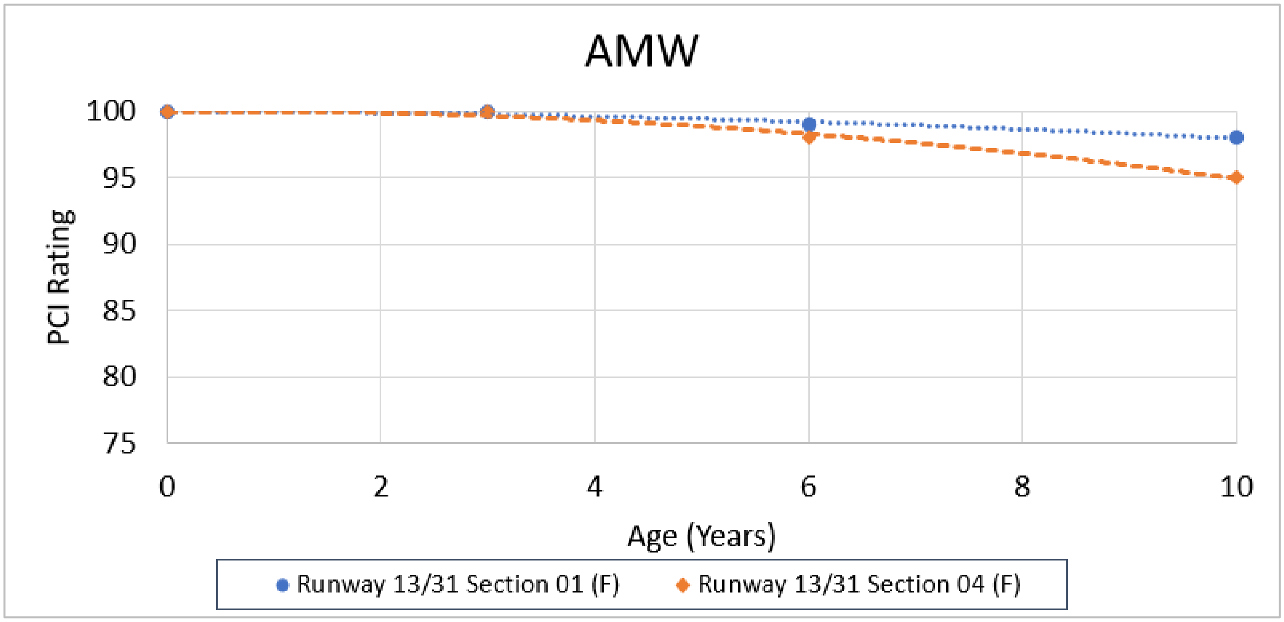


Figure 4. Ames Municipal Airport Runway 13/31 PCI Ratings

4.1.5 Fort Dodge Regional Airport

Fort Dodge Regional Airport (FOD) is a commercial service airport located 3 miles north of Fort Dodge, in Webster County, Iowa. Taxiway C was selected for review and was reconstructed in 2001 using FAA specifications. Plans for this project were not available. Aircraft operations total 10,598 aircraft annually based on 2021 data. Load ratings for Runway 12/30, to which Taxiway C connects, are as follows: Single Wheel —36,000 lb; Double Wheel—58,000 lb.

The 2019 PCI for Taxiway C was 90 and the following distresses were noted: joint spalling, joint seal damage, corner break, and faulting. A plot of the PCI ratings for Taxiway C since the 2001 reconstruction is shown in Figure 5.

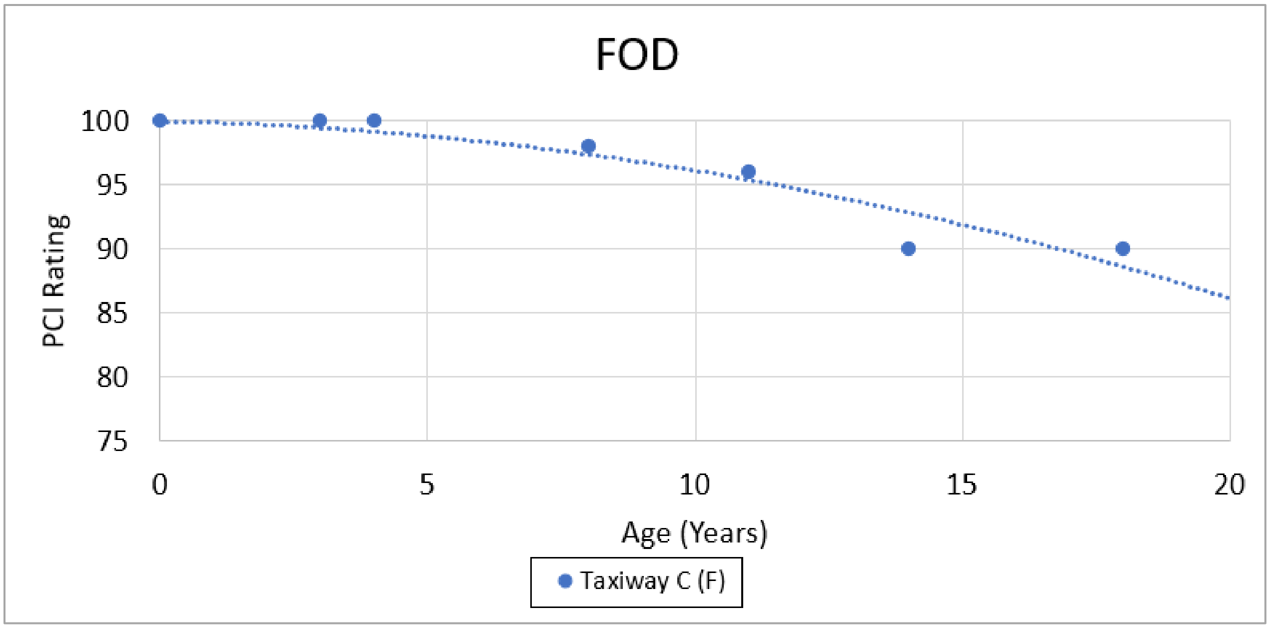


Figure 5. Fort Dodge Regional Taxiway C PCI Ratings

4.1.6 Jefferson Municipal Airport

Jefferson Municipal Airport (EFW) is a GA airport located 2 miles east of Jefferson, in Jefferson County, Iowa. Two sections of Runway 14/32 were selected for review. Runway 14/32 was overlaid and reconstructed in 2001 using state specifications. The plans for this project were not available. Operations totaled 5,750 aircraft annually in 2021. Runway 14/32 has the following load rating: Single Wheel—11,000 lb.

The 2021 PCI for Runway 14/32, sections 01 and 02, were 78 and 81, respectively. Several distresses caused by load, climate, and other elements were all identified during the 2021 evaluation, although the PCI ratings remain fairly high after over 20 years of service. The PCI ratings since the most recent rehabilitation for Runway 14/32 are shown in Figure 6.

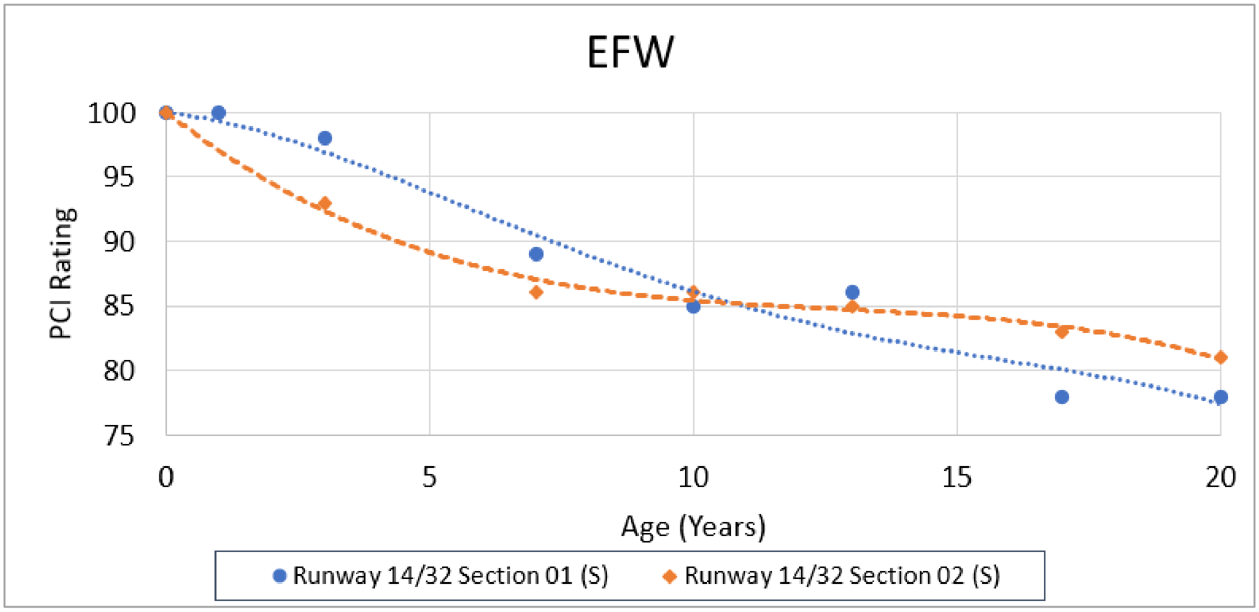


Figure 6. Jefferson Municipal Airport Runway 14/32 PCI Ratings

4.2 MISSOURI

4.2.1 Lee's Summit Municipal Airport

Lee's Summit Municipal Airport (LXT) is a public-use airport located 3 miles north of Lee's Summit, in Jackson County, Missouri. Runways 11/29 and 18/36 were reconstructed in 2017 using FAA and State specifications, respectively. The Runway 11/29 work involved complete reconstruction using 6–9 in of PCC over a 6-in. aggregate base. For Runway 18/36, 9-in. PCC was constructed on a 6-in. aggregate base. Two different sections of Taxiway C were also constructed in 2010 and 2017 using state and FAA specifications, respectively. That work consisted of construction of a 9-in. PCC surface over a 6-in. crushed aggregate for both specifications. An apron (east) was also constructed in 2010 using State specifications, with a 9–in PCC over a 6-in. crushed aggregate base. The most recent aircraft operation data, from AirNav.com (2020), showed 52,500 aircraft annually. Runway 11/29 has the following load ratings: Single Wheel—30,000 lb; Double Wheel—30,000 lb; while Runway 18/36 has the following load ratings: Single Wheel—40,000 lb; Double Wheel—60,000 lb.

During the 2019 inspection, no distresses were recorded on either of the runways. The most prevalent distress on the east apron and Taxiway C was low- to high-severity joint seal damage. Most of the distress deducts are associated with climate, with a very small portion associated with load. The average PCI in 2019 for both runways was 100. The PCI on the 2017 section of Taxiway C was 100 and for the East Apron it was 99. The PCI on the 2010 Taxiway C section was 89. Because of the lack of deterioration for most of the sections, Figure 7 only shows the performance of the two Taxiway C sections.

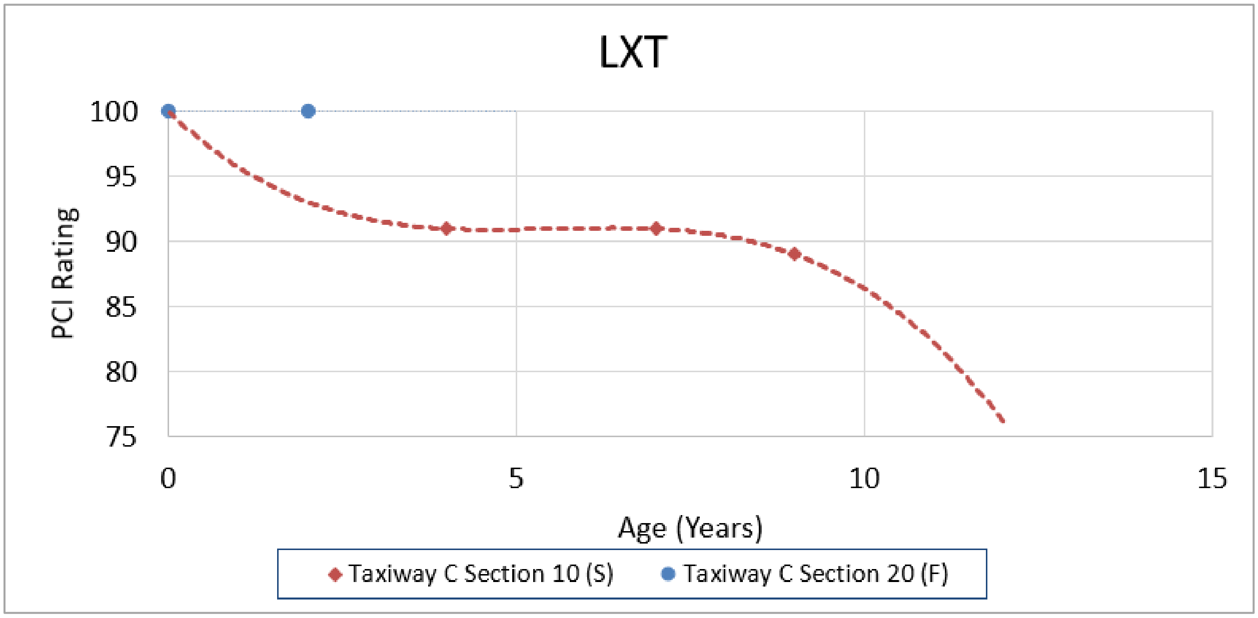


Figure 7. Performance of Lee's Summit Municipal Taxiway C Sections

4.2.2 Eldon Model Airpark Airport

Eldon Model Airpark (H79) is a publicly owned GA airport in Miller County, Missouri. Runway 18/36 and Taxiway A were constructed in 1995 using FAA specifications and have a cross section of 5 in of PCC on a 4-in. crushed aggregate base. A portion of the Runway and Taxiway A were reconstructed in 2010 using state specifications with a 6-in. PCC surface over a 4-in. crushed aggregate base. Annual aircraft operations in 2019 were 10,362 aircraft. Runway 18/36 has a load rating of Single Wheel—30,000 lb. From the 2021 inspection, the average PCIs were 87 and 92 for the runway sections constructed with FAA and state specifications, respectively. For Taxiway A, two sections with FAA specifications had PCIs of 93 and 86, while the section constructed with state specifications had a PCI of 93. The major distress observed on the runway and taxiway was low- to medium-severity joint seal damage. No load-related distress deducts were reported, and the cause of a small percentage of deducts was associated with "other." A plot of the PCI ratings since the most recent rehabilitation is shown in Figure 8.

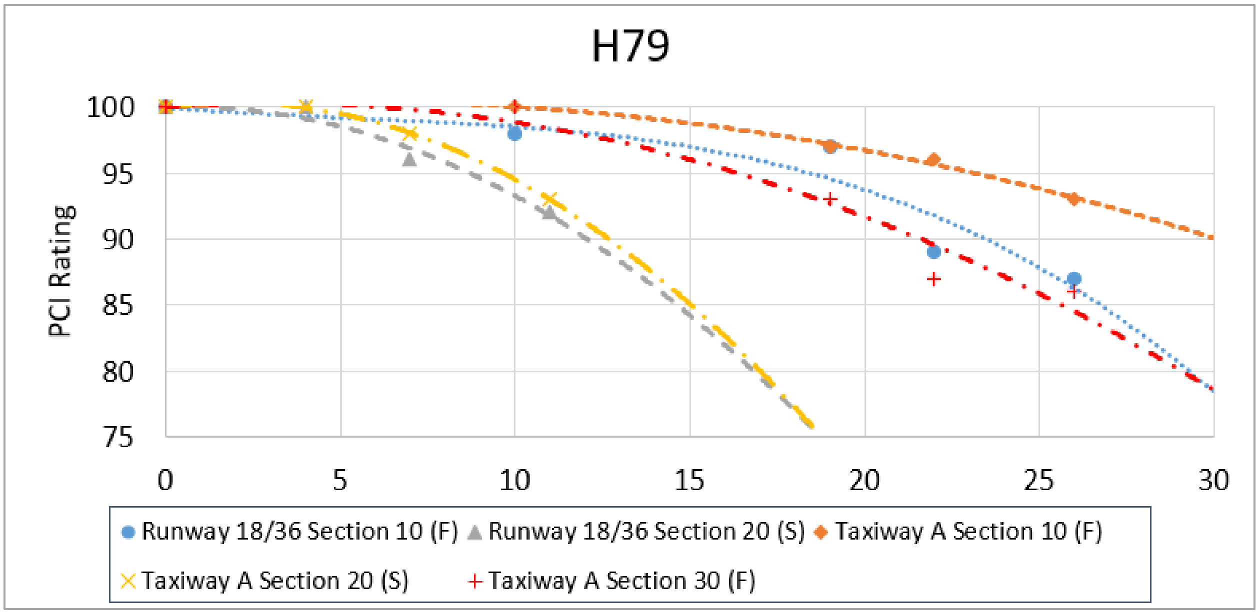


Figure 8. Eldon Model Airpark PCI Ratings

4.2.3 Macon-Fower Memorial Airport

Macon-Fower Memorial Airport (K89) is a publicly owned GA airport located in Macon County, Missouri. Runway 02/20 and Taxiway A were both reconstructed in 2013 using state specifications. The pavement cross section consisted of a 6-in. PCC over a 6-in. crushed aggregate base. Aircraft operations in 2021 totaled 5,024 aircraft annually. Runway 02/20 has a load rating of Single Wheel—12,500 lb.

At the 2020 inspection, the PCI for Runway 02/20 was 95 and for Taxiway A it was 98. The major distresses reported for the runway and taxiway was low- to medium-severity joint seal damage accompanied by low-severity faulting. Most of the distress deduct was associated with climate, while a very small percentage of deduct was associated with “load” and “other.” A plot of the PCI ratings since the most recent rehabilitation is shown in Figure 9.

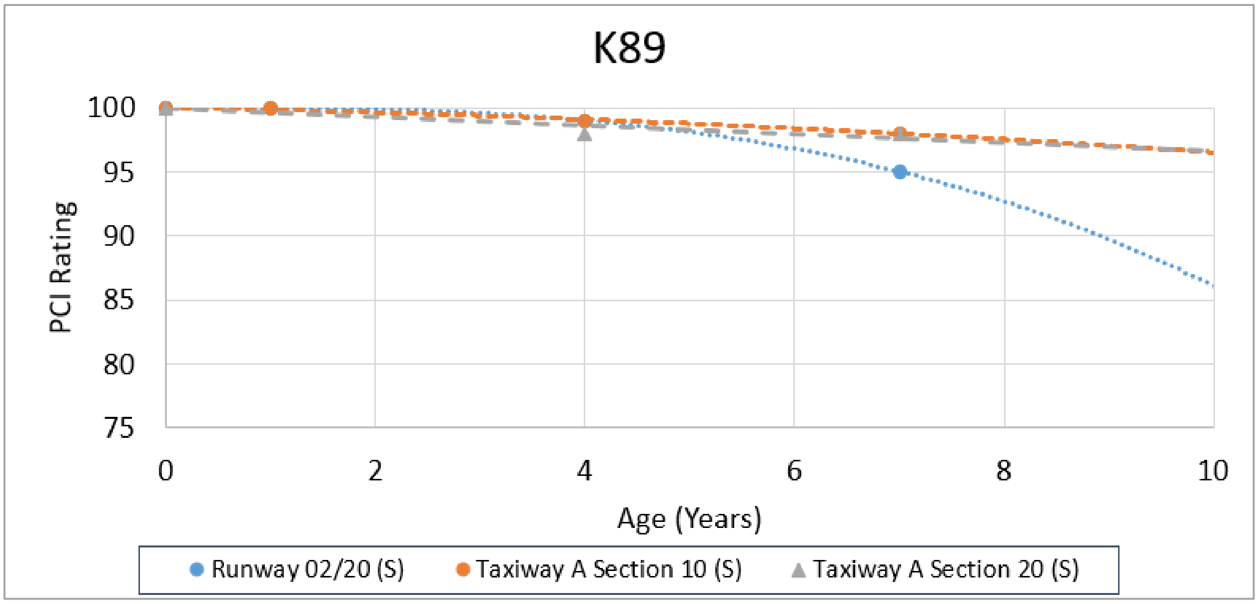


Figure 9. Macon-Fower Memorial PCI Ratings

4.2.4 Branson West Municipal Airport - Emerson Field

Branson West Municipal Airport - Emerson Field (FWB) is a publicly owned GA airport located in Stone County, Missouri. A part of Runway 03/21, Taxiway A, Taxiway D, Apron 1, Apron 2, Apron 3, and T-Hangar 1 were constructed in 2009 using state specifications. Apron 4 was constructed in 2015 using FAA specifications. Both specifications were applied to a cross section consisting of 6 in of PCC on a 4-in. crushed aggregate base. Aircraft operations in 2021 totaled 5,024 aircraft annually. Runway 03/21 has a load rating of Single Wheel—12,500 lb.

The major distresses reported for the Runway, Taxiways, Aprons, and T-hangar were low- to high-severity joint seal damage and low-severity faulting. PCI ratings since the most recent rehabilitation for different pavements at FWB are shown in Figure 10.

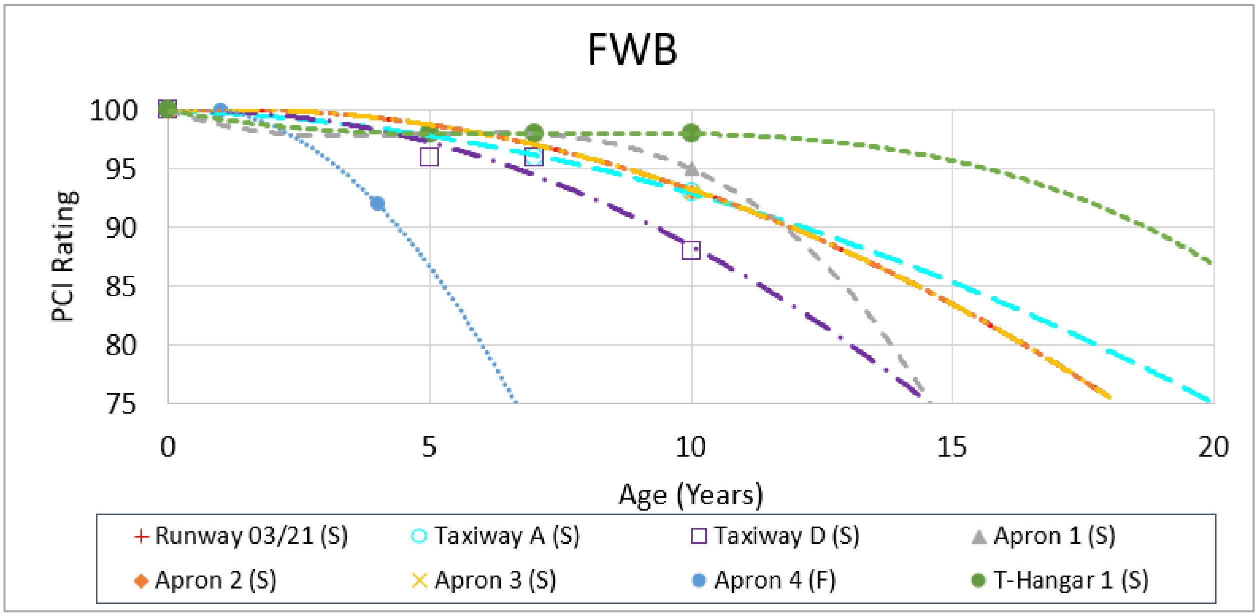


Figure 10. Branson West Municipal-Emerson Field PCI Ratings

4.2.5 Sedalia Regional Airport

Sedalia Regional Airport (DMO) is a publicly owned, GA airport located in Pettis County, Missouri. A portion of Runway 18/36 was constructed in 2004 using FAA specifications, with 6 in of PCC over a 4-in. crushed aggregate base. Another portion of the Runway was reconstructed in 2014 using state specifications with an 8-in. PCC surface placed over a 6-in. crushed aggregate base. A portion of Taxiway A was reconstructed in 2014 using state specifications, while another portion was reconstructed in 2016 using FAA specifications. Both of the Taxiway A projects were constructed as an 8-in. PCC surface over a 6-in. crushed aggregate base. In 2020, annual aircraft operations totaled 11,000 aircraft. Runway 18/36 has the following load rating: Single Wheel—50,000 lb; Double Wheel—65,000 lb.

The most common distresses on the runway include low- to high-severity joint seal damage and low- to medium-severity linear cracking. On the portion of Taxiway A reconstructed in 2014, low- to medium-severity joint seal damage along with low-severity ASR were recorded in the 2019 inspection. The 2004 runway section exhibited a moderate percentage of distress deductions associated with load. For the other sections, most distresses were associated with climate. A plot showing PCI ratings since the most recent rehabilitation for these four different sections is shown in Figure 11.

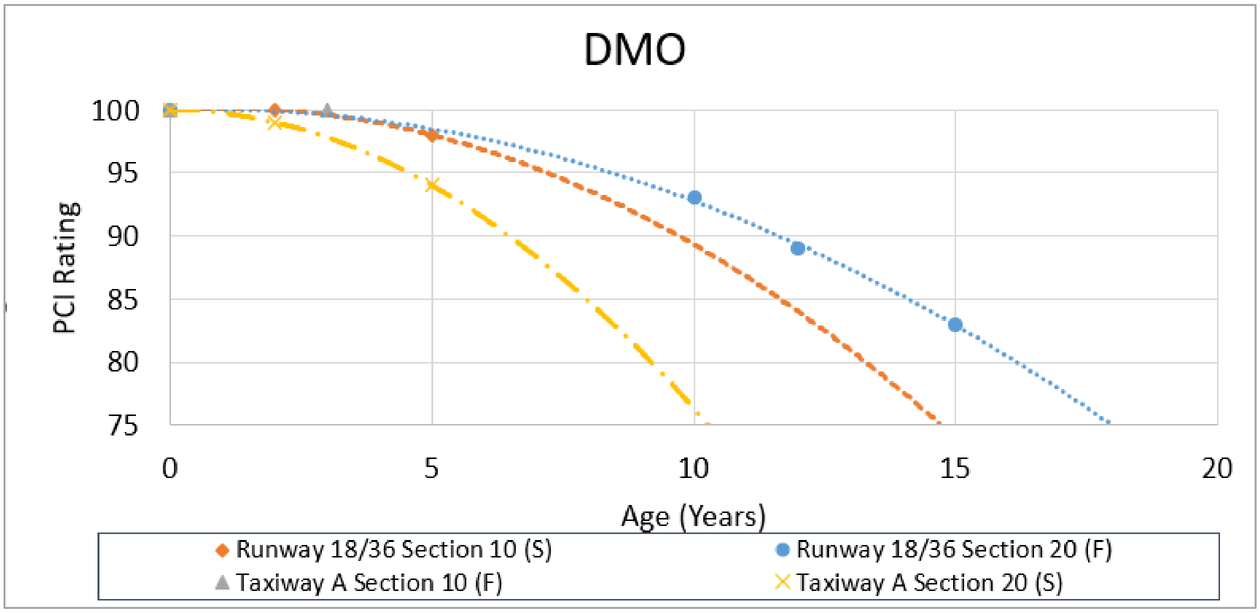


Figure 11. Sedalia Regional PCI Ratings

4.2.6 Omar N. Bradley Airport

Omar N. Bradley Airport (MBY) is a public-use, GA airport located in Randolph County, Missouri. Portions of Taxiway A were constructed in 2009 and 2012 using FAA and state specifications, respectively. Both projects consisted of 6 in of PCC on a 4-in. crushed aggregate base. Annual aircraft operations in 2019 totaled 15,460 aircraft. Runway 13/31 has the following load rating: Single Wheel—30,000 lb; Double Wheel—38,000 lb.

The most prevalent distresses throughout Taxiway A are low- to high-severity joint seal damage, low- to high-severity linear cracking, and low-severity ASR. The section of Taxiway A constructed in 2009 exhibited major distress deductions associated with climate and a small percentage of deductions associated with the "other" and "load" categories. For the section of Taxiway A constructed in 2012, most of the distress deducts were associated with "other," followed by "climate" and "load." PCI ratings since the most recent rehabilitation for different parts of the airport are shown in Figure 12.

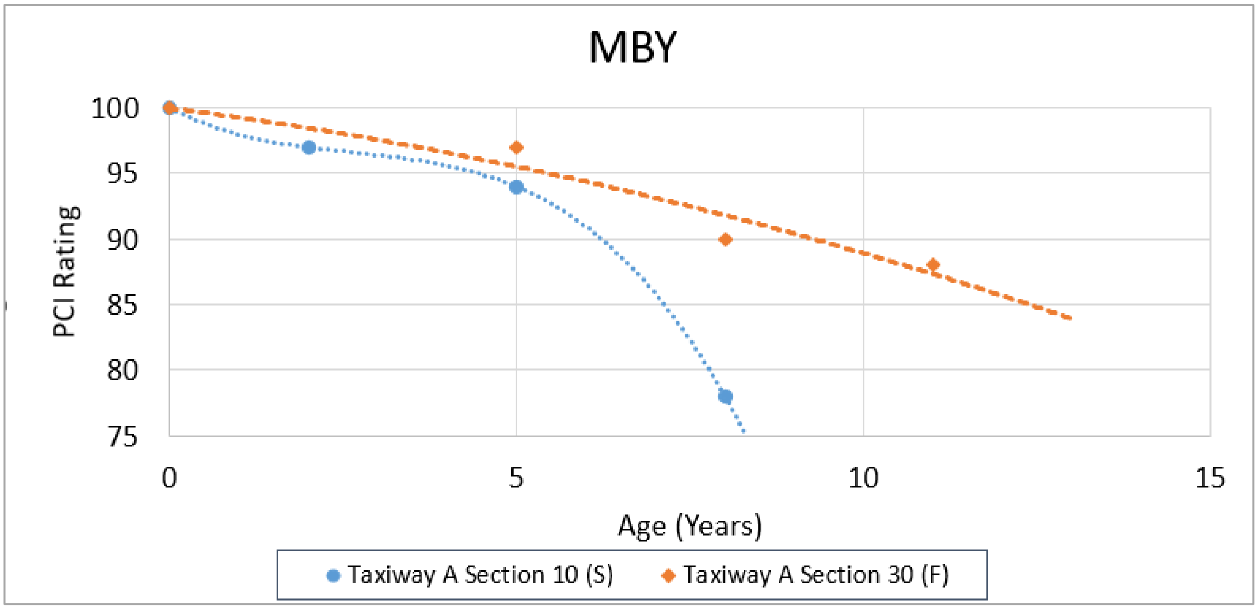


Figure 12. Omar N. Bradley PCI Ratings

4.2.7 Nevada Municipal Airport

Nevada Municipal Airport (NVD) is a publicly owned, GA airport located in Nevada, Missouri, which serves the Vernon County area. Runway 13/31 and Taxiway A were reconstructed in 2012 using FAA specifications with a cross section consisting of 6 in of PCC on a 4-in. crushed aggregate base. In 2019, annual operations totaled 7,310 aircraft. Runway 13/31 has the load rating of Single Wheel—30,000 lb.

From the 2019 condition survey, the most common distresses along the taxiway were low- to medium-severity joint seal damage and high-severity small patching. No load associated distress deductions were recorded for the runway. Taxiway A distress deductions were evenly distributed between "climate" and "other" category. The 2019 PCIs were 97 for Taxiway A and 96 for Runway 13-31. Because of the limited deterioration after 7 years, this performance is not graphed.

4.2.8 Lamar Municipal Airport

Lamar Municipal Airport (LLU) is a publicly owned, GA airport, which is located 2 miles southwest of Lamar, in Barton County, Missouri. Runway 03/21, Runway 17/35, Taxiway A, Runway 03 Holding Apron, and Runway 35 Holding Apron were all constructed in 2013 using state specifications with a cross section consisting of 6 in of PCC on a 4-in. crushed aggregate base. In 2019, annual airport operations totaled 5,320 aircraft. Runway load ratings are not available, although Runway 03/21, which is shorter, has a pavement classification number (PCN) of 10/R/C/W/T.[1]

[1] The PCN represents the load-carrying capacity of a pavement. See https://skybrary.aero/articles/pavement-classification-number-pcn for a brief explanation of the PCN.

With respect to performance, the most prevalent type of distress throughout the runway and runway holding apron include low-severity joint seal damage. Distress deducts for Runway 17/35 were associated with climate. For Runway 03/21, the majority was associated with "climate," while a small percentage was classified as "other." The Runway 03 Holding Apron had deductions associated with load, climate, and other. From the 2019 survey, the Runway 03 Hold Apron PCI was 97 and 100 for the remaining sections. Because of the lack of deterioration to date, no graph of these data is provided.

4.2.9 Hannibal Regional Airport

Hannibal Regional Airport (HAE) is a publicly owned GA facility located to the west of downtown Hannibal, in Marion County, Missouri. Runway 17/35 and Taxiway A were constructed in 2002 and 2015, respectively, using FAA specifications. Both had a 6-in. PCC surface, but the Runway PCC was built over a 4-in. crushed aggregate base while the Taxiway had a 6-in. crushed aggregate base. In 2018, annual operations totaled 9,661 aircraft. Runway 17/35 has a Single Wheel—12,000 lb load rating.

The most common runway distresses include low-severity faulting, joint spalling, and ASR. Pumping, high-severity joint seal damage, and faulting are the major distresses recorded for the taxiway. PCI ratings since the most recent rehabilitation for different parts of the airport are shown in Figure 13.

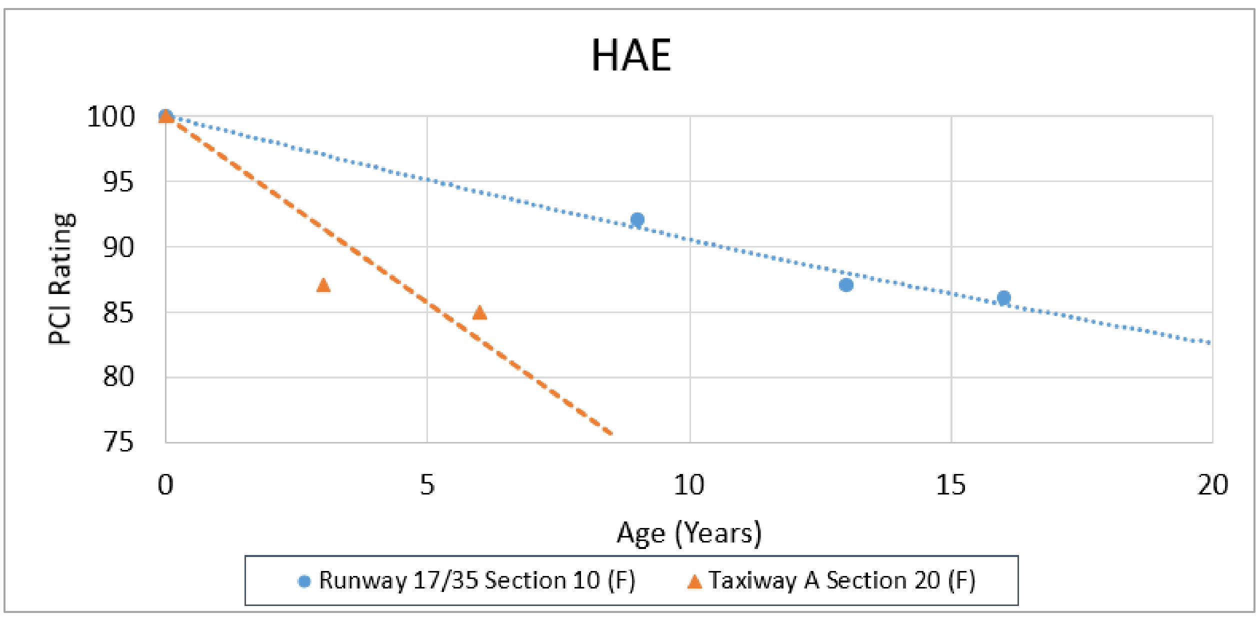


Figure 13. Hannibal Regional PCI Ratings

4.3 DATA SUMMARY

The PCI data used in the analysis is summarized in Table 2 for Iowa and Table 3 for Missouri. In each table it is assumed that the PCI in the project's year of construction was 100.

Table 2. Summary of Iowa Airport PCI Data by Year

Airport Name	Description	Year Paved	Spec.	Notes	PCI																		
					2000	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014	2015	2017	2018	2019	2020	2021
BNW	Runway 15/33	2007	FAA	Section 01							100			99			98		95			91	
MPZ	Apron 02	2010	FAA	Section 01										100			91		87			81	
	Apron 02	2009	FAA	Section 03									100	100			98		95			88	
	Apron 02	2004	State	Section 02				100		97				97			92		85			80	
EBS	Runway 14/32	2001	State	Section 01		100	100		100				98			97		95			89		
	Taxiway 01	2002	State	Section 02			100		100				98			97		92			92		
	Runway 5/23	2000	FAA	Section 01	100				98				98			96		93			89		
	Taxiway 03	2002	FAA	Section 01			100		100				99			97		95			91		
	Taxiway 04	2002	FAA	Section 01			100		100				99			97		96			91		
AMW	Runway 13/31	2009	FAA	Section 01									100			100		99			98		
	Runway 13/31	2009	FAA	Section 04									100			100		98			95		
FOD	Taxiway C	2001	FAA	Section 01		100		100	100				98			96		90			90		
EFW	Runway 14/32	2001	State	Section 01		100	100	98				89			85		86			78			78
	Runway 14/32	2001	State	Section 02		100		93				86			86		85			83			81

Notes:

- Years for which there are no PCI data are removed to improve chart visibility.
- PCI data highlighted in green show known year of construction.

Table 3. Summary of Missouri Airport PCI Data by Year

Airport Name	Description	Year Paved	Spec.	Section	PCI																	
					1995	2002	2003	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
LXT	Runway 11/29	2017	FAA	20														100		100		
		2017	FAA	30														100		100		
	Taxiway C	2017	FAA	20														100		100		
	East Apron	2010	State	10							100				99			99		99		
	Runway 18/36	2017	State	10														100		100		
	Taxiway C	2010	State	10							100				91			91		89		
H79	Taxiway A	1995	FAA	10	100				100						97			96				93
		1995	FAA	30	100				100						93			97				86
	Runway 18/36	1995	FAA	10	100				98						97			89				87
	Taxiway A	2010	State	20							100				100			98				93
	Runway 18/36	2010	State	20							100				100			96				92
K89	Taxiway A	2013	State	10										100	100			99			98	
		2013	State	20										100				98			98	
	Runway 02/20	2013	State	10										100	100			99			95	
FWB	Apron 4	2015	FAA	10												100	100			92		
	Apron 1	2009	FAA	10						100					98		98			95		
	Apron 2	2009	State	10						100					98		98			93		
	Apron 3	2009	State	10						100					98		98			93		
	Runway 3/21	2009	State	10						100					98		98			93		
	T-Hangar 1	2009	State	10						100					98		98			98		
	Taxiway A	2009	State	10						100					98		96			93		
	Taxiway D	2009	State	10						100					96		96			88		
DMO	Runway 18/36	2004	FAA	20				100							93		89			83		
	Taxiway A	2016	FAA	10													100			100		
	Runway 18/36	2014	State	10											100		100			98		
	Taxiway A	2014	State	20						100					100		99			94		
MBY	Taxiway A	2009	FAA	30											97			90			88	
	Taxiway A	2012	State	10									100		97			94			78	
NVD	Taxiway A	2012	FAA	10									100		100		100			97		
	Runway 13/31	2012	FAA	20									100		100		98			96		
LLU	Hold Apron 35	2013	State	10										100	100		100			100		
	Hold Apron 3	2013	State	10										100	100		100			97		
	Runway 3/21	2013	State	20										100	100		100			100		
	Runway 17/35	2013	State	10										100	100		100			100		
	Taxiway A	2013	State	20										100	100		100			100		
HAE	Runway 17/35	2002	FAA	10		100										87			86			96*
	Taxiway A	2015	FAA	20												100			87			85

Notes:

- Years for which there are no PCI data are removed to improve chart visibility.
- PCI data highlighted in green show known year of construction.

*Crack sealing raised the PCI; data used in analysis is from 2018 condition survey.

5. SPECIFICATIONS FOR CONCRETE HIGHWAY AND AIRPORT PAVEMENTS

Because of the differences between highway and airport pavements, construction requirements for airport pavement projects are usually different than those of highway pavement projects, especially when airport pavements are constructed according to the FAA's P-501 specification. To identify significant differences between the two types of specifications, the state concrete pavement specifications (which includes both highway and airport specifications) that were used for airfield projects documented in this report were compared to current FAA concrete pavement specifications. The specifications reviewed include the following:

- FAA: *Standard Specifications for Construction of Airports*, AC 150/5370-10H (Item P-501 Cement Concrete Pavement). Date: 12/21/2018 (errata 8/19/2020) (FAA, 2020).

- Iowa Department of Transportation (IaDOT): *Standard Specification for Highway and Bridge Construction* (Section 2301. Portland Cement Concrete Pavement). Date: 2015 (IaDOT, 2015a).

- Missouri DOT (MoDOT): *Standard Specification for Highway Construction* (Section 501 Concrete). Date 2023 (MoDOT, 2023).

While the FAA's P-501 specification specifies one class of material, state DOT specifications are generally written to provide a range of material classes (e.g., pavement, curb, structural, or other items). For airport paving, higher quality DOT mixes are assumed to be used. For paving, the IaDOT (Section 4115) appears to use A-mix, C-Mix, and Quality Management Concrete (QM-C) mixtures. The QMC mixture appears to be used for larger paving projects and is most consistent with the current FAA specifications, in that the mixture is developed by the contractor and uses the combined aggregate gradation. The MoDOT specification (Section 501) indicates a "Paving Concrete" or "Pavement Concrete" and is used in this comparison.

5.1 AGGREGATE REQUIREMENTS

The FAA P-501 incorporates specific reactivity testing requirements. The contractors are required to test and evaluate fine and coarse aggregates used in the concrete for alkali-aggregate reactivity, in accordance with both ASTM C1260 and ASTM C1567. MoDOT (2023) references ASTM C1260 testing for coarse aggregates for source approval but does not appear to indicate requirements within the Section 1005 aggregate requirements.

The IaDOT (2015a) specifications do not directly address reactivity testing of aggregates. While the IaDOT specifications include multiple aggregate durability classes, for airport pavements, it is assumed Class 3 or greater would be necessary as follows:

- Class 3 Durability: No deterioration of pavements of non-Interstate segments of the Interstate Road System after 20 years of age and less than 5% deterioration of the joints after 25 years; or a salt susceptibility quality maximum of 1.5 (Iowa Test Method [TM] 223) and secondary pore index maximum of 25 (Iowa TM 219).

- Class 3i Durability: No deterioration of pavements of the Interstate Road System after 30 years of service and less than 5% deterioration of the joints after 35 years; or a salt susceptibility quality maximum of 1.0 (Iowa TM 223) and secondary pore index maximum of 20 (Iowa TM 219).

Additional requirements for coarse and fine aggregates are summarized in Tables 4 and 5.

Table 4. Summary of Coarse Aggregate Requirements

Material Test	**Test Value**		
	FAA (2020)	**IaDOT (2015a) (Section 4115)**	**MoDOT (2023) (Section 1005)**
Resistance to degradation, maximum percent	40 (ASTM C131)	50 (crushed stone) / 35 (gravel) (AASHTO T96)	50 (AASHTO T96)
Soundness of aggregates, maximum percent	12 using sodium sulfate or 18 using magnesium sulfate (ASTM C88)	–	18 (TM 14)
Flat, elongated, or flat and elongated particles, maximum percent	8 (ASTM D4791)	–	5.0
D-cracking (freeze-thaw), durability factor, minimum	95 (ASTM C666) or State cert.	–	75 (AASHTO T161, Procedure B)
Alumina	–	0.5 (TM 222)	–
A Freeze	–	0.5 (TM 211, Method A)	–
Clay lumps and friable particles, maximum percent	1.0 (ASTM C142)	0.5 (IM 368)	–
Material finer than No. 200 sieve, maximum percent	1.0 (ASTM C117)	1.5	2.5
Lightweight particles, maximum percent	0.5 (ASTM C123 using a medium with a density of Sp. Gr. of 2.0) (1.0 for non-freeze areas)	–	–
Chert (less than 2.40 Sp. Gr.) (ASTM C123 using a medium with a density of Sp. Gr. of 2.40), maximum percent	0.1	3.0 (IM 372)	4.0
Coal and carbonaceous shale	–	0.5 (IM 372)	–
Total of all shale, similar objectionable materials, and coal combined	–	1.0 (IM 372)	–
Organic materials, except coal	–	0.01 (TM 215)	–
Deleterious rock, maximum percent	–	–	6.0
Shale, maximum percent	–	–	1.0

TM = State test method; IM = State instructional memorandum
Sp. Gr. = Specific gravity

Table 5. Summary of Fine Aggregate Requirements

Material Test	Test Value FAA (2020)	IaDOT (2015a) (Section 4110)	MoDOT (2023) (Section 1005)
Soundness of aggregates by use of sodium sulfate or magnesium sulfate, maximum percent	10 using sodium sulfate or 15 using magnesium sulfate (ASTM C88)	–	–
Sand equivalent, minimum	45 (ASTM D2419)	–	–
Fineness modulus	2.50 < = FM < = 3.40 (ASTM C136)	No less than 2.60	–
Clay lumps and friable particles, maximum percent	1.0 (ASTM C142)	–	–
Coal and lignite, maximum percent	0.5 using a medium with a density of Sp. Gr. of 2.0 (ASTM C123) (1.0 for non-freeze areas)	–	0.50
Total deleterious, maximum percent	1.0	–	–
Shale and coal, maximum percent		2.0 (IM 344)	–
Clay lumps and shale	–	–	0.25
Total lightweight particles, including coal and lignite, maximum percent	–	–	0.50
Material passing no. 200 sieve	–	–	2.0 (natural sand) / 4.0 (manufactured sand)
Other deleterious substances	–	–	0.10

TM = State Test Method; IM = State Instructional Memorandum
Sp. Gr. = Specific gravity

In addition to the coarse and fine aggregate requirements summarized above, FAA P-501 requires the Engineer to indicate the coarse aggregate maximum size, which is noted to typically be 1 1/2-in., 1-in., or 3/4-in. based on locally available aggregates and freeze-thaw vulnerability (FAA, 2020). The FAA P-501 aggregate gradation is based on the combined aggregate gradation and is developed by the Contractor. The combined gradation is established to provide a Coarseness Factor (CF) and Workability Factor (WF) that fall within the parallelogram for “well graded,” as illustrated in Figure 14.

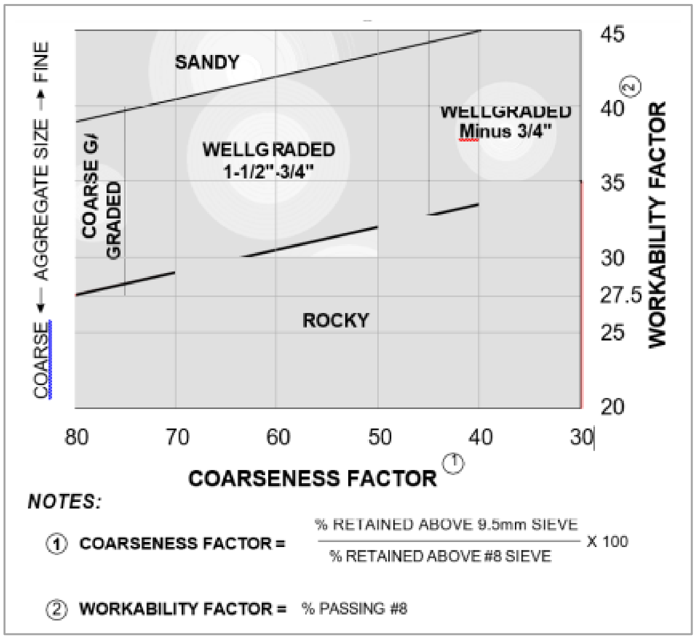


Figure 14. Aggregate Proportioning Guide (Tri-Service Pavements Working Group, 2019)

IaDOT indicates a maximum aggregate greater than or equal to 1 in. The gradation for the QM-C is based on the combined gradation, as discussed above for the FAA. There are three C-Mix gradations with 1-in. and 3/4-in. maximum aggregate sizes. MoDOT also uses combined gradation for their optimized mixes.

IaDOT has also included the *Tarantula curve* as part of combined gradation (IaDOT IM 532). The Tarantula curve is a modified percent-retained curve developed at Oklahoma State University (Cook et al., 2015), as illustrated in Figure 15.

While the approaches to aggregate gradation are similar between the specifications (primarily an optimized gradation), the required properties vary. For instance, the FAA specifications have clear reactivity requirements, while the state specifications are not as stringent. State specifications likely reflect issues that have occurred locally rather than nationwide. The aggregate sources within each state may meet FAA requirements, but different test methods (e.g., state test methods versus ASTM) and results are generally used, so there is not currently a straight comparison.

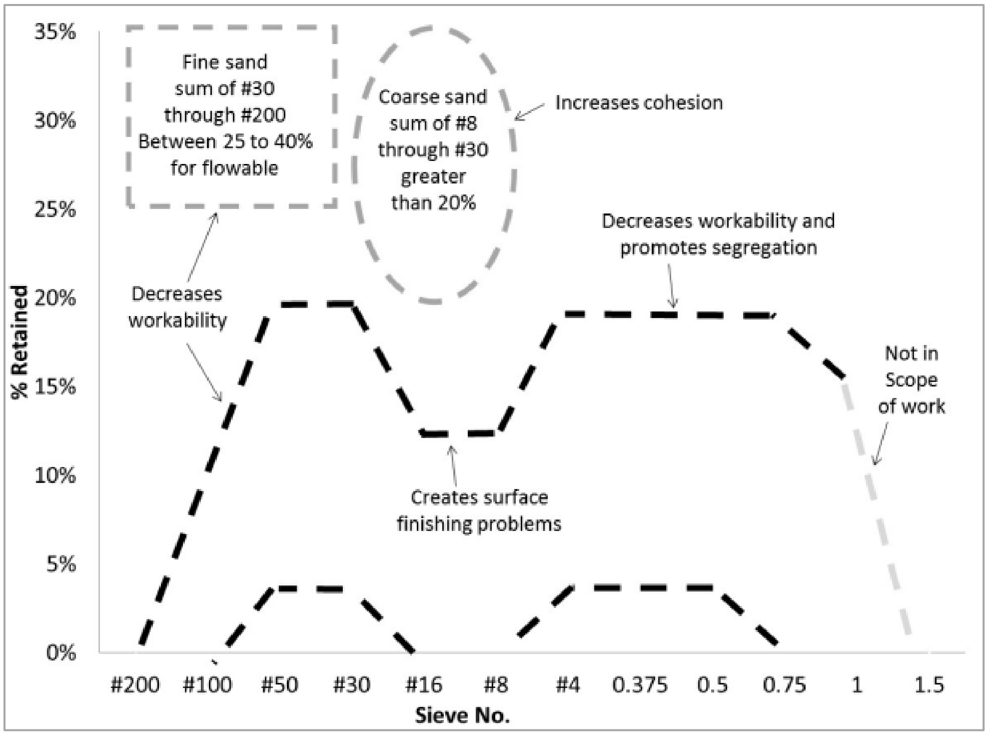


Figure 15. Tarantula Curve Aggregate Blending (Cook et al., 2015)

5.2 CEMENT AND CEMENTITIOUS MATERIALS

The allowable cement and cementitious materials for the three specifications are summarized in Table 6. In general, the common cement types and more common cementitious materials (fly ash and ground granulated blast-furnace slag [GGBFS]) are allowed in all three specifications. There are varying ranges of allowable substitution rates as well as chemical composition requirements in the supplemental materials.

The FAA recently released Engineering Brief (EB) No. 106, *Guidance for the Implementation of Changes in Industry Cement Standard Specifications*, which provides additional guidance on cement used for airport pavements (FAA, 2023). The FAA EB addresses the use of blended cements with the industry phasing out straight Type I and II cements. The FAA EB also addresses the elimination of low alkali cements from ASTM C150 and the proposed alkali loading limit for concrete mixes, which is less than or equal to 3.0 lb/yd^3. IaDOT specifications limit the ASTM C150 cements to 0.60% equivalent alkali and the ASTM C595 blended cements to 0.75% equivalent alkali. While the state specifications discuss alkali limitations, they do not currently discuss calculation of the total equivalent alkali loading, which should be assessed according to EB No. 106, especially for higher cement-content mixes.

Table 6. Summary of Cement and Cementitious Materials

Material	FAA (2020)	IaDOT (2015a)	MoDOT (2023)
Cement	Type I, II, or V (ASTM C150); Type IP*, IS, or IL (ASTM C595); Types GU, HS, MH (ASTM C1157)	Type I or Type II (ASTM C150); Type IP, Type IS, or Type IL (ASTM C595)	Type I (AASHTO M85); Type IP, Type IS, or Type IL (AASHTO M240)
Fly Ash	ASTM C618, except loss of ignition maximum shall be less than 6%; CaO content of less than 15% and a total alkali content less than 3% per ASTM C311	Class C or F (AASHTO M295); alkali content not to exceed 1.50%	Class C or F (AASHTO M295); loss of ignition maximum shall be less than 1.5%; CaO content of less than 23%; 25% maximum
GGBFS Cement	ASTM C989, Grade 100 or Grade 120; rate between 25 to 55% of total cementitious	ASTM C989, Grade 100 or Grade 120	AASHTO M302, Grade 100 or Grade 120; only use with Type I or II cement; 30% maximum
Raw or Calcined Natural Pozzolan	ASTM C618, Class N	–	–
Ultrafine Fly Ash or Ultrafine Pozzolan (average particle size less than 6 microns)	ASTM C618, Class F or N	–	–
Silica Fume	–	–	ASTM C1240; 8% maximum
Metakoalin	–	–	AASHTO M321; 15% maximum

*IP = Portland-pozzolan cement with moderate sulfate resistant properties
IS = Portland-slag cement
IL = Portland-limestone cement
MH = Moderate heat of hydration
HS = High sulfate resistance
GU = General use

CaO = Calcium oxide

5.3 ADMIXTURES

Allowable liquid admixtures are generally similar between the three specifications, as summarized in Table 7, with the exception of the material certification agency. The FAA includes the use of lithium nitrate for the purpose of ASR mitigation.

Table 7. Summary of Admixtures

Material	FAA (2020)	IaDOT (2015a)	MoDOT (2023)
Air-entraining	ASTM C260	AASHTO M154	AASHTO M154
Water-reducing	ASTM C494, Type A, B, or D	AASHTO M194	AASHTO M194, Type A
Set-retarding	ASTM C494, Type A, B, or D	AASHTO M194	AASHTO M194, Type B or D
Set-accelerating	ASTM C494, Type C	–	AASHTO M194, Type C or E
Other	Lithium nitrate	–	–

5.4 CONCRETE MIX AND MIX DESIGN

General mix design requirements are summarized in Table 8. In the FAA P-501, the strength requirement is based on flexural strength. The 28-day flexural strength requirement typically ranges from 600 to 750 psi. For the FAA P-501, the specified flexural strength is generally assumed to be 5 percent less than the design flexural strength. The IaDOT QM-C indicates a minimum flexural strength of 640 psi (IaDOT, 2015b), while the MoDOT specifications indicate a minimum compressive strength of 4,000 psi (MoDOT, 2022).

Table 8. Summary of Concrete Mix Design Requirements

Item	Value		
	FAA (Item P-501)	IaDOT (QM-C)	MoDOT (Section 501)
Cementitious content, minimum (lb/yd^3)	470*	560	517
Strength	600–750 psi, 28-day flexural	640 psi, 28-day flexural	4,000 psi, 28-day compressive
Slump, slip-form, in	2	Do not apply to slip form	–
Slump, fixed-form, in	4	1/2 to 4	–
Air content, percent	2 –7 (Varies by maximum size aggregate and exposure level)	8 ± 2 (slip form); 7 ± 1.5 (non-slip form)	4.5–7.5
w/c ratio	0.38–0.45	0.40–0.42	0.50 maximum

* 517 for severe freeze-thaw, deicer, or sulfate exposure.

While there are slight differences, such as the IaDOT's slightly higher air content or the MoDOT's allowable higher water-cement (w/c) ratio, the approaches are relatively similar. Strength requirements, which would need to be based on flexural strength to meet FAA requirements, do not correspond between all three.

5.5 QUALITY CONTROL

Each of the reviewed specifications requires the contractor to provide a quality control plan. The general requirements for each specification are summarized in Table 9.

Table 9. Summary of Quality Control Requirements

FAA	IaDOT	MoDOT
• Fine aggregate: gradation, moisture content, deleterious substances • Coarse aggregate: gradation, moisture content, deleterious substances • Combined gradation • Slump • Air content • Unit weight and yield • Temperatures • Smoothness and grade	• Fine aggregate moisture content • Coarse aggregate moisture content • Gradation, combined % passing • Air content • Unit weight (mass) of plastic concrete • Water/cementitious ratio • Vibrator frequency	• Fine aggregate gradation • Coarse aggregate gradation • Optimized Gradation • Slump • Air content • Deleterious content • Coarse aggregate absorption • Thin or elongated pieces • Thickness • Compressive strength specimens

5.6 ACCEPTANCE, PERCENTAGE WITHIN LIMITS

Concrete acceptance is generally based on assessment of lots for all three specifications. However, the establishment of lots varies; the FAA indicates a lot consists of a day's production not to exceed 2,000 cubic yards, IaDOT divides sections into 2,000-square yard lots, and MoDOT considers a single day of production, not to exceed 7,500 square yards. Although the state lot sizes are by square yard, the resulting cubic yard lot sizes are less than the FAA maximum lot size for pavements ranging from 6–9 in thick for the typical GA pavement. Lots are typically broken into four to six sublots.

The general acceptance testing included in the specifications are summarized in Table 10. The number and frequency of testing within lots and sublots varies considerably between the specifications.

Table 10. Summary of Acceptance Criteria

FAA	IaDOT	MoDOT
• Strength • Thickness • Grade • Smoothness	• Strength (flexural) • Thickness • Smoothness • Unit Weight and Yield • Temperature • Air Content • Edge Slump	• Strength (compressive) • Thickness • Surface Texture • Air Content • Slump • Aggregate Gradation • Coarse Aggregate Deleterious • Aggregate Absorption • Thin or Elongated Pieces

The FAA P-501 adjusts payment based on percentage of material within specification limits (PWL) for strength and thickness and has pay reductions for grade, smoothness, and areas of repairs. IaDOT's QM-C has pay adjustments based on the average CF and WF for each lot according to their Materials IM 530 (IaDOT, 2015b). Section 2301 of the IaDOT specification also includes a thickness adjustment based on a calculated thickness index. MoDOT uses PWL with an upper and lower limit for strength and thickness. While the MoDOT QA testing includes duplicate QC tests, most are at a reduced rate for comparative verification in contrast with the FAA requirements.

5.7 CONSTRUCTION

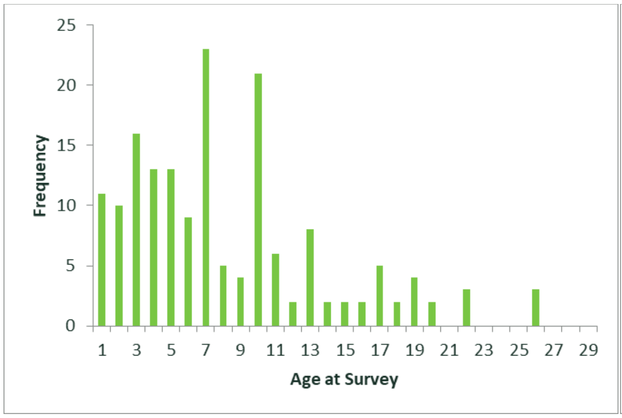
There are several differences between construction requirements in the FAA P-501 and state specifications:

- FAA P-501 requires a control strip.
- FAA P-501 addresses the need for a debonding agent, such as choke stone.
- While all specifications include language regarding weather and rain protection, the FAA P-501 includes hot weather placement (the state specifications include cold weather) as well as the use of HIPERPAV® (High-Performance Concrete Paving software) or a temperature management plan in general.
- The state specifications are written in terms of roadway aspects, such as dealing with curb and gutter, railways, and other appurtenances that are not encountered on airfields.
- The state specifications have additional language for surface finishing methods, such as tining or macro texture.
- The state specifications requirements for managing damage/repairs are less explicit than those in the FAA P-501 specification.

6. ANALYSIS

The PCI ratings for the Iowa and Missouri projects were compiled and summarized based on the type of specifications used (FAA versus state highway) and the location (Iowa versus Missouri).

General attributes of the full dataset are best understood through basic histograms for age and PCI, shown in Figure 16, which reflect the skew in the available data. In the histogram for PCI, the data for "Good" pavements (i.e., PCI is 86–100) is parsed into three groups: 86–91, 92–97, and 98–100. The histograms of the full data set demonstrate both skew to younger pavements and skew to pavements with PCIs between 98 and 100. Of the 166 observations in the dataset, 95 pavements were aged 7 years or less, and 80 pavements had PCI values between 98 and 100.



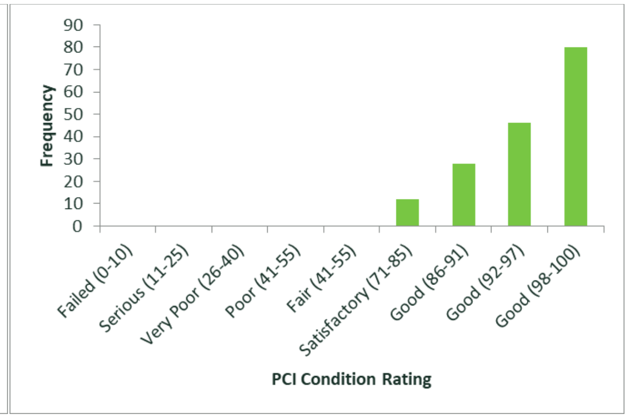


Figure 16. Histograms for Age at Survey (left) and PCI (right)

Basic statistical analyses of subsets of the full set of observations are shown in Table 11. These subsets include a presentation of the data by location (Iowa or Missouri) and paving specification (FAA P-501 or state). These focused descriptions of the data are in general agreement with the larger set of observations.

Table 11. Basic Statistics for Relevant Subsets of the Total Rigid Pavement PCI Observations

IA-FAA	AGE	PCI		IA-STATE	AGE	PCI
Mean	8.8	95.4		Mean	10.1	90.9
Standard Error	0.77	0.74		Standard Error	1.08	1.34
Median	8.5	97		Median	10	92
Mode	3.0	100.0		Mode	10.0	100.0
Standard Deviation	4.8	4.6		Standard Deviation	5.8	7.2
Range	18	19		Range	19	22
Minimum	1	81		Minimum	1	78
Maximum	19	100		Maximum	20	100
Sum	335	3626		Sum	294	2637
Count	38	38		Count	29	29
MO-FAA	**AGE**	**PCI**		**MO-STATE**	**AGE**	**PCI**
Mean	10.8	93.8		Mean	5.5	97.0
Standard Error	1.35	0.95		Standard Error	0.35	0.48
Median	10	96		Median	5	98
Mode	2.0	100.0		Mode	7.0	100.0
Standard Deviation	8.0	5.6		Standard Deviation	2.8	3.9
Range	25	17		Range	10	22
Minimum	1	83		Minimum	1	78
Maximum	26	100		Maximum	11	100
Sum	379	3283		Sum	354	6210
Count	35	35		Count	64	64

One feature of the subsets in Table 11 is that, despite their PCI observations skewing to the right, these subsets include “Satisfactory” ratings at earlier ages (i.e., not beyond Year 20, for example). Furthermore, there are observations of older P-501 sections (from H79 in Missouri), which also happen to have relatively high PCIs. These and other features of the observations complicate linear regression analysis by paving specification, as is shown in the linear regression analysis, illustrated in Figures 17 and 18, which describe linear regression for the state and FAA P-501 observations, respectively.

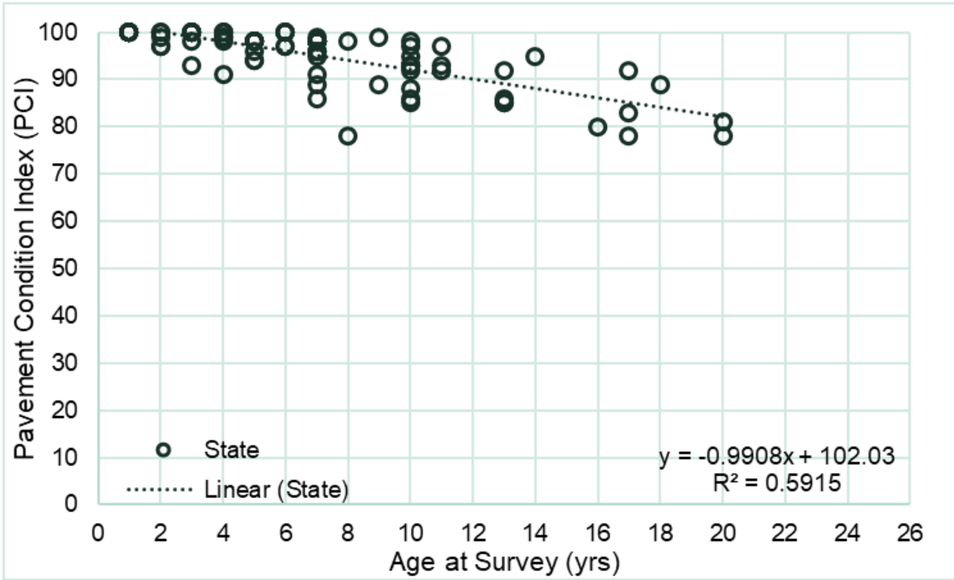


Figure 17. Linear Regression of PCI vs Age Observations for State Specification Sections

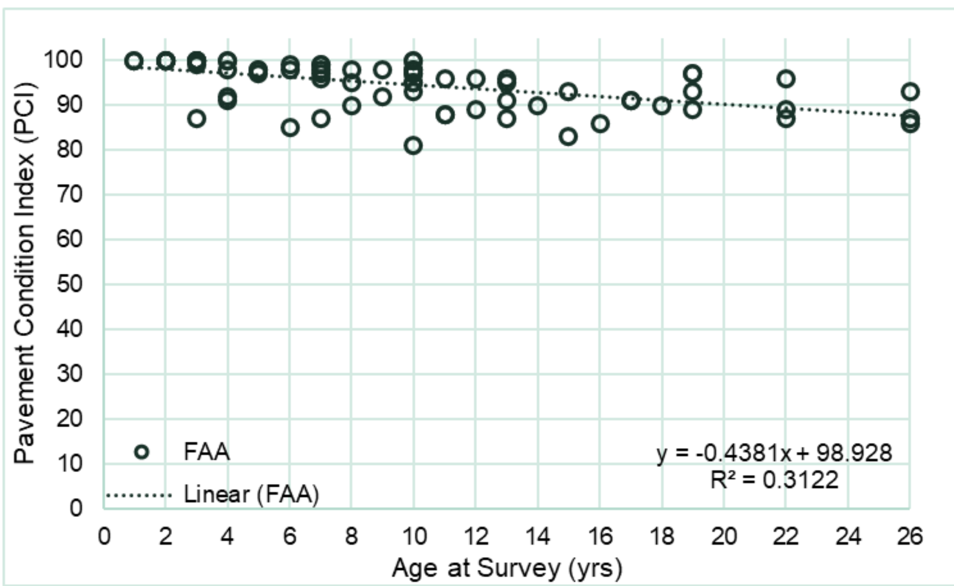


Figure 18. Linear Regression Analysis for PCI vs Age Observations for FAA P-501 Sections

Note that Year 0 (initial) observations have been removed to attempt to clarify views of the data. In any case, it is difficult to attribute meaning to the dissimilarity in the regression equations. That is, while the delta of state sections is -0.99 PCI/year and FAA P-501 sections is -0.44 PCI/year, these relationships are associated with relatively low R-squared scores. The linear regression equations explain only 59% and 31% of variability in the state and FAA datasets, respectively.

Despite the unfavorable features of the dataset and the complications they create in providing clear views of behavior, the following multiple regression analyses on the data were performed with the PCI as the independent variable and the following three dependent variables:

- Age at survey (AGE).
- Location, which is a binary variable (BLOC) indicating either Iowa (0) or Missouri (1).
- Specification, which is a binary variable (BSPC) indicating either FAA P-501 (0) or state (1).

The linear regression equation for PCI as a function of location (state), specification (FAA, state), and age is shown in equation 1. As this analysis was performed with a 95% confidence interval, $\alpha = 0.05$.

$$PCI = 1.50*\mathrm{BLOC} + 1.60*\mathrm{BSPC} - 0.63*\mathrm{AGE} + 98.5$$
$$R^2 = 0.43 \qquad (1)$$

Table 12 demonstrates that the *p*-values associated with all features of the regression equation are less than α, and therefore the selected dependent variables (BLOC, BSPC, and AGE) and intercept are significant.

Table 12. Summary of Multiple Regression Analysis, Including Analysis of Variance

Regression Statistics					
Multiple R	0.658				
R Square	0.433				
Adjusted R Square	0.423				
Standard Error	4.195				
Observations	166				
ANOVA					
	df	SS	MS	F	Significance F
Regression	3	2178.0	726.0	41.3	7.3E-20
Residual	162	2850.8	17.6		
Total	165	5028.8			
	Coefficients	Standard Error	t Stat	*p*-value	
Intercept	98.5	0.798	123.5	0.000	
BLOC	1.50	0.684	2.2	0.030	
BSPC	1.60	0.688	2.3	0.021	
AGE	-0.63	0.060	-10.5	0.000	

ANOVA = Analysis of Variance
df = Degrees of freedom
f = Ratio of explained variance to unexplained variance
MS = Mean square
SS = Sum of squares

Similar to the linear regression analyses for data subsets by specification, the regression model has an associated low R-squared for engineering analysis: this equation explains only 43% of the variability in the data. It appears that the inability of the regression model to explain the variability is a consequence of dataset features discussed above.

To determine if the specification type impacted the types of distresses encountered, the percentage of distress deductions in the three generally accepted categories of cause (load, climate, other) was summarized for each of the projects, as shown in Table 13. The following distresses are commonly associated with each category:

- Load—corner break, linear cracking, shattered slab
- Climate—blowup, durability cracking, joint seal damage, ASR
- Other—small patch, large patch, popouts, pumping, scaling/crazing, faulting, shrinkage cracking, joint spalling, corner spalling

Examining these results, it is emphasized that the lowest PCI in this grouping is 78, which is not very low, and the oldest pavement at the time of the survey is 21 years, which is not very old (see Figure 15). To further put these characteristics of the available data in perspective, the mean ages of all of these pavements is low, as shown in Table 13, and the PCIs are all in the Good category. Current FAA standards require a minimum pavement service life of 20 years. Figures 17 and 18 suggest that pavements constructed with either FAA or state specifications are likely to achieve at least 20 years of life with a PCI of about 80.

Table 13. Percent Distress Deducts by Cause

State	Airport	Branch/Section	PCI	Survey Year	Age at Survey	% Distress Deducts by Cause			Spec. Type
						Load	Climate	Other	
Iowa	BNW	Runway 15/33-01	91	2020	13	10	65	25	FAA
	MPZ	Apron 02-01	81	2020	10	49	48	3	FAA
		Apron 02-02	80	2020	16	0	47	53	State
		Apron 02-03	88	2020	11	0	51	49	FAA
	AMW	Runway 13/31-01	98	2019	10	0	100	0	FAA
		Runway 13/31-04	95	2019	10	0	83	17	FAA
	FOD	Taxiway C-01	90	2019	18	8	67	25	FAA
	EBS	Runway 05/23-01	89	2019	19	43	54	3	FAA
		Runway 14/32-01	89	2019	18	9	56	35	State
		Taxiway 01-02	92	2019	17	9	56	35	State
		Taxiway 03-01	91	2019	17	0	71	29	FAA
		Taxiway 04-01	91	2019	17	0	72	28	FAA
	EFW	Runway 14/32-01	78	2021	20	39	46	15	State
		Runway 14/32-02	81	2021	20	29	57	14	State
Missouri	LXT	Runway 18/36-10	100	2019	2	0	0	0	State
		Runway 11/29-20	100	2019	2	0	0	0	FAA
		Runway 11/29-30	100	2019	2	0	0	0	FAA
		Taxiway C-10	89	2019	9	4	89	7	State
		Taxiway C-20	100	2019	2	0	0	0	FAA
		East Apron-10	99	2019	9	0	100	0	State
	H79	Runway 18/36-10	87	2021	21	0	88	12	FAA
		Runway 18/36-20	92	2021	11	0	87	13	State
		Taxiway A-10	93	2021	21	0	61	39	FAA
		Taxiway A-20	93	2021	11	0	90	10	State
		Taxiway A-30	86	2021	21	0	86	14	FAA
	K89	Runway 02/20-10	95	2021	8	9	75	16	State
		Taxiway A-10	98	2021	8	0	100	0	State
		Taxiway A-20	98	2021	8	0	67	33	State
	FWB	Runway 03/21-10	93	2019	10	0	95	5	State
		Taxiway A-10	93	2019	10	0	95	5	State
		Taxiway D-10	88	2019	10	17	47	36	State
		T-Hangar 1-10	98	2019	10	28	72	0	State
		Apron 1-10	95	2019	10	0	100	0	State
		Apron 2-10	93	2019	10	11	87	2	State
		Apron 3-10	93	2019	10	0	64	36	State
		Apron 4-10	92	2019	4	0	100	0	FAA
	DMO	Runway 18/36-10	98	2019	5	0	100	0	State
		Runway 18/36-20	83	2019	15	38	56	6	FAA
		Taxiway A-10	100	2019	3	0	0	0	State
		Taxiway A-20	94	2019	5	0	63	37	FAA
	MBY	Taxiway A-10	78	2020	8	18	28	54	State
		Taxiway A-30	88	2020	11	16	57	27	FAA
	NVD	Runway 13/31-20	97	2019	7	0	100	0	FAA
		Taxiway A/10	96	2019	7	0	57	43	FAA
	LLU	Runway 03/21-20	100	2019	6	0	89	11	State
		Runway 17/35-10	100	2019	6	0	100	0	State
		Taxiway A-20	100	2019	6	0	0	0	State
		Hold Apron 03-10	97	2019	6	38	41	21	State
		Hold Apron 35-10	100	2019	6	0	0	0	State
	HAE	Runway 17/35-10	96*	2021	19	17	0	83	FAA
		Taxiway A-20	85	2021	6	0	65	35	FAA

* PCI = 86 in 2018 prior to crack sealing (16 years)

Of the 51 different pavement sections represented in Table 13 (23 constructed with FAA specifications and 28 constructed with state specifications), 18 showed distresses caused by load (7 constructed to FAA specifications and 11 constructed to state specifications). The average PCI for the FAA sections with load distress is 88, while the average PCI for the state specification sections is 89. Aside from the dataset's limitations, this suggests that neither group of specifications contributes unduly to load-related deterioration.

All but eight sections exhibited climate-related distresses, a category of distresses that notably includes ASR and durability cracking, both of which are attributed to construction materials, which might be screened differently based on the specification used. Looking more closely at those data, two apron sections at Mount Pleasant Airport in Iowa showed ASR; one based on FAA specifications, and one based on FAA specifications. In Missouri, ASR was identified on pavement sections at the following airports:

- Sedalia Taxiway A, Section 20 (FAA specifications)
- Hannibal Runway 17/35, Section 10 (FAA specifications)
- Omar N. Bradley Taxiway A, Section 10 (state specifications) and Section 30 (FAA specifications)

The very limited results do not indicate a comparative advantage of FAA materials over state-specified materials in controlling ASR. This may be attributed to the fact that all the specifications screen the aggregates to some extent (not necessarily both ASTM C1260 and ASTM C1567 as in the FAA specification) and permit supplementary cementing materials (SCM).

A final analysis reviewed airports where direct comparisons could be made between the performance of similar pavements (e.g., runway to runway and apron to apron) constructed with both specifications (FAA and state). Five airports between the two states include pavement sections constructed following both types of specifications:

- Lee's Summit (LXT), Missouri
- Branson West (FWB), Missouri
- Sedalia (DMO), Missouri
- Mount Pleasant (MPZ), Iowa
- Webster City (EBS), Iowa

In several cases, the different specifications were used on different sections of the same branch, while in others they were used on completely different pavements. Without further insights into variables that might impact differential performance, including the obvious difference in ages for three of the five comparisons, it can be stated that at least one factor that would be similar for the different pavements is the environment.

Table 14 identifies the paired pavements at each airport, including the PCI obtained at the most recent inspection and the rate of deterioration for each pavement expressed as a decrease in PCI points per year since construction.

Table 14. Comparison of Rate of Deterioration (PCI Points/Year) for Pavements at the Same Airport Constructed with FAA and State Specifications

Airport	Branch	Spec (Year Built)	PCI (Last Inspection Year)	PCI Change/Year
LXT	Runway 11/29 Runway 18/36	FAA (2017) State (2017)	100 (2019) 100 (2019)	0 0
FWB	Apron 04 Apron 01, 02, 03	FAA (2015) State (2009)	92 (2019) 93.7 (avg) (2019)	-2/year -0.6/year
DMO	Runway 18/36	FAA (2004) State (2014)	83 (2019) 98 (2019)	-1.1/year -0.4/year
MPZ	Apron 02	FAA (2009/10) State (2004)	84.5 (avg) (2020) 80 (2020)	-1.5/year -1.25/year
EBS	Runway 05/23 Runway 14/32	FAA (2000) State (2001)	89 (2019) 89 (2019)	-0.6/year -0.6/year

Pavements constructed with state specifications appear to have a lower rate of deterioration compared to those constructed with FAA specifications. However, the deterioration rates are the same for the two instances where the pavement ages are approximately the same. It is important to acknowledge that many variables that could affect performance are not considered here, including the following: construction conditions (weather, season), specification differences that emerge with the evolving understanding of materials and construction issues, design and traffic, and contractor/construction quality. This dataset is not considered sufficiently large or varied to draw further conclusions.

7. CONCLUSIONS AND RECOMMENDATIONS

The Federal Aviation Administration (FAA) Reauthorization Act of 2018, Section 136, requires the FAA to allow the use of state highway specifications for airfield pavement construction at non-primary airports serving aircraft with a gross weight of less than 60,000 lb. Instances in which state specifications may be substituted for the FAA specification include these conditions: it is requested by the state, safety will not be negatively impacted, and the life of the pavement will not be shorter than if constructed using FAA specifications. While this is relatively new legislation, the FAA has permitted the use of state highway specifications for the construction of airports (under certain conditions) since 1977.

Highway specifications are not developed to account for the range of loads, tire pressures, and types of loading seen on airport pavements. However, both state highway and FAA specifications have evolved to reflect improved understanding of the impacts of materials, mix designs, construction methods, and other factors on pavement performance.

The FAA initiated this study specifically to evaluate the performance of previously constructed airport rigid pavements that used highway specifications and to compare their performance to those constructed using FAA specifications. Therefore, the overall purpose of this study was to provide the FAA with data to determine if state highway materials and construction requirements for rigid pavements can perform satisfactorily at non-primary, public-use airports serving aircraft less than 60,000-lb gross weight. This project follows a similar approach used in a recently completed project that examined the same topics for flexible pavements (West et al., 2023).

This project had two primary objectives. One was to evaluate the in-service performance of airport pavements constructed following state highway rigid pavement specifications for aircraft with a gross weight less than 60,000 lb. The other was to identify differences in material requirements in state highway specifications versus FAA standard specifications for rigid pavement materials. To accomplish these objectives, the research team identified states where there were sufficient pavement condition data to compare performance between pavements constructed with the two types of specifications, analyzed the data, and formulated conclusions.

After considering the availability of data from nine states known to construct concrete airfield pavements, pavement performance data and construction information (when available) was collected from 51 paving projects in Iowa and Missouri. Of those, 28 used state specifications and 23 used FAA specifications. The following conclusions are drawn:

- There is a statistically significant difference in performance based on age, location (state), and specification used, although the regression model in the analysis did not explain the variability in the performance results.

- Neither the FAA nor state specifications contributed to a significant difference in load-related distress. Without correcting for factors known to impact load-carrying capabilities (including location, applied loads, pavement age, and pavement branch), state specifications performed as well as FAA specifications in controlling load-related distresses.

- Distresses with climate as the contributing cause occurred frequently in both FAA and state specification projects. This category includes both materials distresses, such as alkali-silica reaction (ASR) and durability cracking (d-cracking), and joint seal damage. Joint seal damage was a frequently recorded distress, but neither ASR nor d-cracking were prevalent.

- At airports where head-to-head performance comparisons between FAA and state specifications could be made (again without further consideration of other variables affecting performance), state specification projects consistently performed at least as well as FAA specification projects.

- All of the projects were relatively new for concrete pavements (mean age at most recent survey less than 10 years) and in good condition (mean PCI greater than 90). This created challenges in discerning meaningful differences in performance for pavements constructed with the different specifications.

- In considering projects in only two states, broader conclusions about projects constructed with state and FAA specifications may not be extrapolated from the presented data. In particular, it is possible that the good performance of state specifications may reflect the experience of those specific states in improving their highway concrete specifications to the point where they contribute to good overall performance on airfield pavements. Caution is urged in extrapolating from the findings of this report to the use of state highway specifications for airfield projects in other states without further study.

- A comparison of the specifications was made using current FAA and state specifications and not the specifications that were in effect when the different projects were constructed. The comparison shows several significant differences:

  – The FAA requires testing for aggregate reactivity, while states may identify and certify known local sources that have provided non-reactive aggregate. Additional screening in compliance with FAA specifications might not be needed in states where approved aggregate sources are already identified. A related observation is that state requirements may be more stringent for exposure conditions not typically observed on airfield pavements (e.g., exposure of aggregates to road salts) and may not need the same restrictions.

  – Cement types are similar. Low-alkali cements are handled differently.

  – Similar admixtures are allowed and mix design approaches are similar. However, the FAA has specific strength requirements that may not match those used by the states.

  – There are differences in the acceptance criteria, including lot/sublot size. There are some variations in the approaches to the percentage within limits (PWL).

  – The FAA has multiple construction requirements that are not necessarily mirrored by the states, although at least some of the differences are attributed to the differences between airfield and highway pavements (e.g., surface finishing).

Based on the above conclusions, the following recommendations are made:

- Expanding the search of pavement sections to more agencies with older pavements constructed using both specification types, or repeating this study in 5 years if such pavements are not available would provide further useful insights.

- The analysis of pavement performance of airfield pavements constructed with FAA and state specifications shows differences based on age, location, and specification type, but the effect of specification type could not be singled out. This supports the use of state highway specifications for airfield asphalt pavements at non-primary airports serving aircraft that do not exceed 60,000 lb, if requested by the state.

- Where state specifications are used, care should be taken to ensure that appropriate aggregates and cementitious materials are used. Some state specifications may not reflect best practices.

- The FAA P-501 (FAA, 2020) outlines several construction best practices that may not be replicated in state specifications but should be considered. These include the use of control strips, following hot- and cold-weather placement guidelines, smoothness specifications, and damage repairs. FAA acceptance criteria could also focus better on what is important for airfield pavement performance, such as the previously noted smoothness and foreign-object debris prevention.

The incorporation of certain elements of FAA P-501 into state specifications should contribute to better performance of airfield concrete pavements constructed with state specifications.

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APPENDIX A—AIRPORT REPORTS

A.1 IOWA

A.1.1 Boone Municipal Airport (BNW)

Owner: City of Boone
923 8th St
Boone, IA 50036
Phone 515-432-4211
Chairman Airport Commission Joe Pundzak
Manager: Dale E. Farnham
424 Cpl Roger Snedden Dr
Boone, IA 50036-7520
Phone 515-432-1018

Boone Municipal Airport (BNW) is located 2 miles southeast of Boone, in Boone County, Iowa. The National Plan of Integrated Airport Systems (NPIAS) for 2011-2015 categorized it as a general aviation (GA) airport (having at least 10 locally based aircraft). The airport covers 206 acres (83 hectares [ha]) at an elevation of 1,160 ft (354 m). It has two runways: 15/33, which has a concrete surface and measures 4,808 ft by 75 ft, and 02/20, which has a turf surface and measures 3,248 ft by 146 ft (Figure A-1).

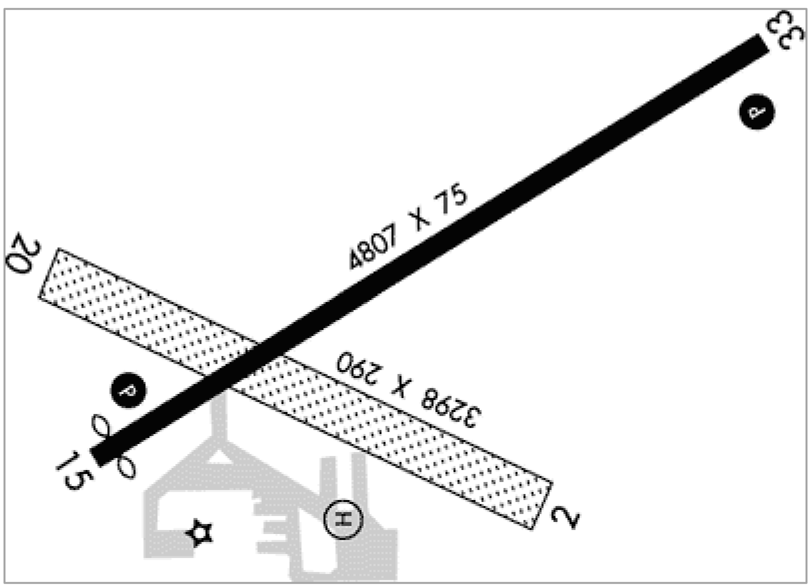

Figure A-1. Boone Municipal Airport Diagram (source: www.aopa.org)

Runway 15/33

- Pavement Classification Number (PCN): 6 /R/D/W/U
- Concrete overlay of Runway 15/33 (FAA Specifications) completed June 2007
- FAA AIP Project No. 3-19-009-09

Specifications and Plans

A set of construction plans were provided by the airport manager that included geotechnical information and exploration sites, demolition plans, typical sections, runway profiles, and other information. Overall, the plans incorporated a 6-in. white top overlay with a cross slope that varies through the entire runway. The typical section for the main portion of Runway 15/33 can be found in Figure A-2.

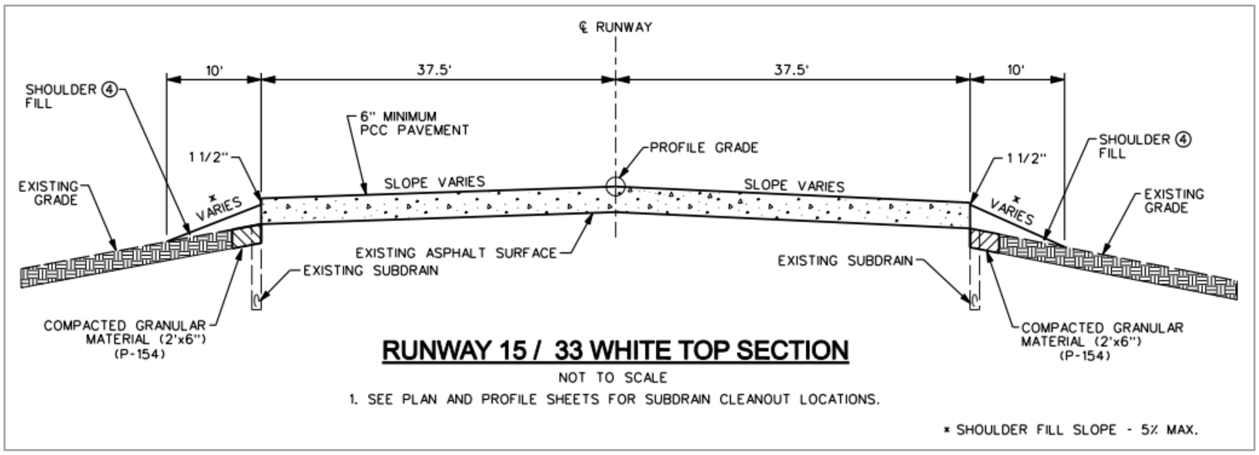

Figure A-2. Runway 15/33 Typical Section

The consultant for the rehabilitation design was Snyder & Associates, Inc., Ankeny, Iowa.

The following specifications were identified in the provided set of plans:

- ITEM P-101 PAVEMENT REMOVAL—requirements for pavement removal to prevent damage of adjacent or underlying material
- ITEM P-505 PCC OVERLAY
- ITEM P-620 PAVEMENT MARKING—requirements for pavement marking material and application

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information available.

Quality Control and Acceptance Results

No information available.

Pavement Performance Data

Based on the Iowa Department of Transportation (IaDOT) Pavement Management Reports, the PCI measured in 2020 was 91, and the following distresses were identified: joint seal damage, faulting, and corner spalls. A plot of the PCI ratings since the project was completed is shown in Figure A-3.

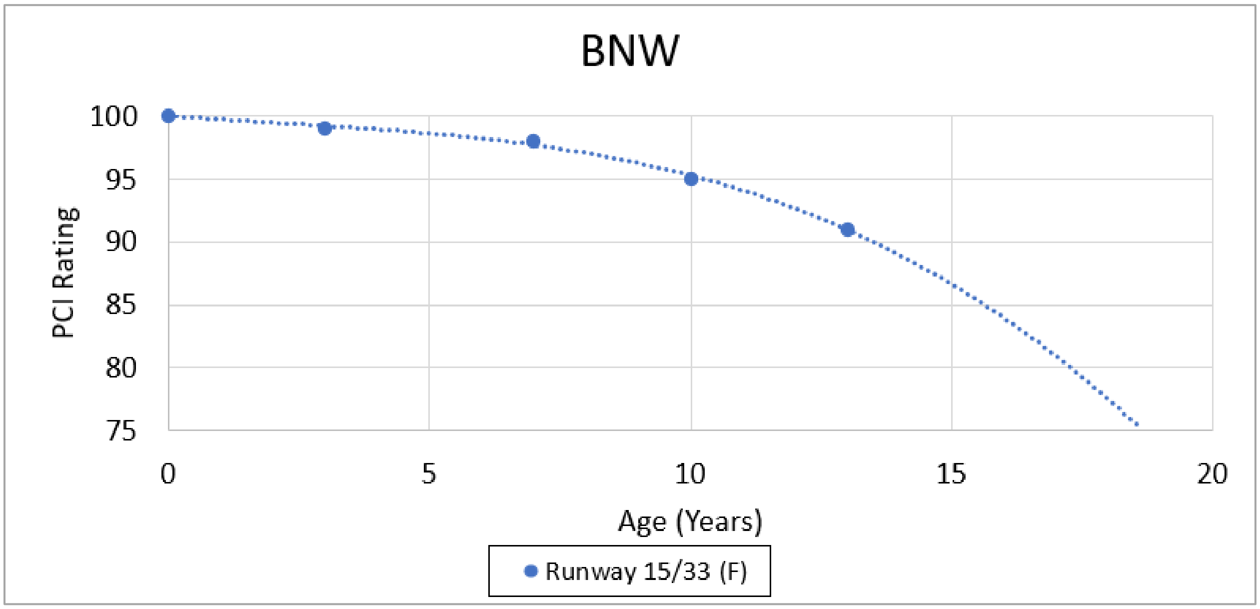

Figure A-3. Runway 15/33 PCI Rating

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the Airport Data and Information Portal (ADIP), the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 0
- GA Local: 5,687
- GA Itinerant: 4,426
- Military: 7,887
- Total Operations: 18,000

Based on the ADIP, Runway 15/33 has the following load rating:

- Single Wheel—30,000 lb

Pavement Condition Evaluation

The 2022 PCI for Runway 15/33 was 91, and the following distresses were identified: joint seal damage, faulting, and corner spalls.

A.1.2 Mount Pleasant Municipal Airport (MPZ)

Ownership: Publicly owned
Owner: City of Mount Pleasant
220 West Monroe
Mt. Pleasant, IA 52641
Phone 319-385-1470
Manager: Clifford Baker
1720 South Iris Street
Mt. Pleasant, IA 52641
Phone 319-385-8122 or 319-385-1487

Mount Pleasant Municipal Airport (MPZ) is located 3 miles southeast of Mount Pleasant, in Henry County, Iowa. The NPIAS for 2011-2015 categorized it as a GA airport (having at least 10 locally based aircraft). The airport covers 124 acres (50 ha) at an elevation of 731 ft (223 m). It has two runways: 15/33, which has a concrete surface and measures 4,001 ft by 75 ft, and 3/21, which has a turf surface and measures 1,967 ft by 120 ft (Figure A-4).

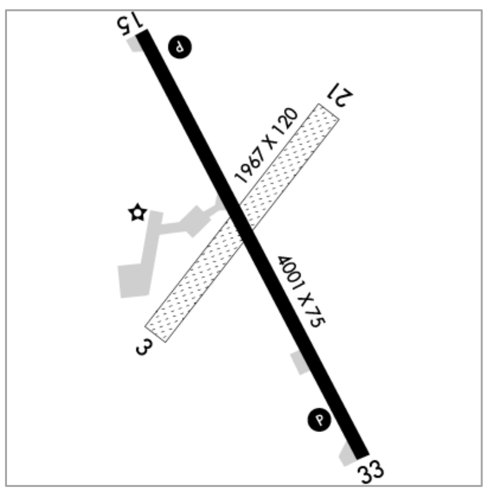

Figure A-4. Mount Pleasant Municipal Airport Diagram (source: www.aopa.org)

Apron 02

Rehabilitation and new construction of Apron 02 completed in:

- New construction of Section 02—2004 (State Specifications)
- New construction of Section 03—2009 (FAA Specifications)
- Rehabilitation of Section 01—2010 (FAA Specifications)
  - FAA AIP Project No. 3-19-0062-10-2010

Specifications and Plans

Apron 02 Section 01

A set of construction plans were provided by the airport manager, which included geotechnical information and exploration sites, demolition plans, typical sections, apron profiles, and other information. Overall, the plans included a rehabilitation of Apron 02 Section 01. The typical section for the main portion of Apron 02 is shown in Figure A-5.

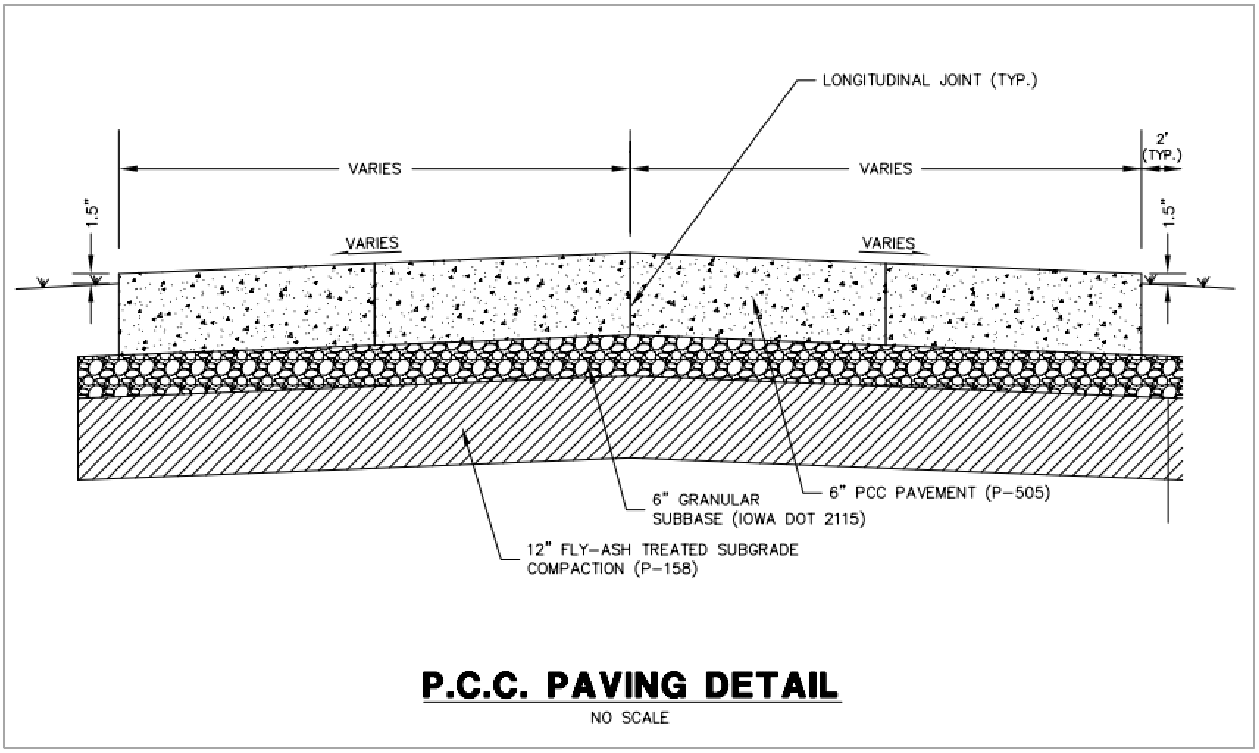

Figure A-5. Apron 02 Typical Section

The consultant for the rehabilitation design was Snyder & Associates, Inc., Ankeny, Iowa.

The following specifications were identified in the provided set of plans:

- ITEM P-101 PAVEMENT REMOVAL—requirements for pavement removal to prevent damage of adjacent or underlying material
- ITEM P-501 PORTLAND CEMENT CONCRETE PAVEMENT—requirements for materials and construction of Portland cement concrete (PCC) pavement
- ITEM P-620 PAVEMENT MARKING—requirements for pavement marking material and application

Apron 02 Section 02 and Section 03

No plans or specifications were acquired for these sections.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Pavement Performance Data

Apron 02:

Based on the Iowa DOT Pavement Management Reports in 2020:

- Section 01 had a PCI of 81. The following distresses were observed:
  - Low-severity small patch
  - Low- and medium-severity corner break
  - Low- and medium-severity linear crack
  - Low- and medium-severity shattered slab
  - Medium-severity joint spalling
  - Medium- and high-severity joint seal damage
- Section 02 had a PCI of 80. The following distresses were observed:
  - Low- and medium-severity corner spalling
  - Low- and medium-severity alkali-silica reaction (ASR)
  - Medium-severity joint spalling
  - High-severity joint seal damage
- Section 03 had a PCI of 88. The following distresses were observed:
  - Low-severity ASR
  - Low-severity faulting
  - Medium-severity joint seal damage
  - Medium-severity joint spalling

A plot of the PCI ratings since the most recent construction is shown in Figure A-6.

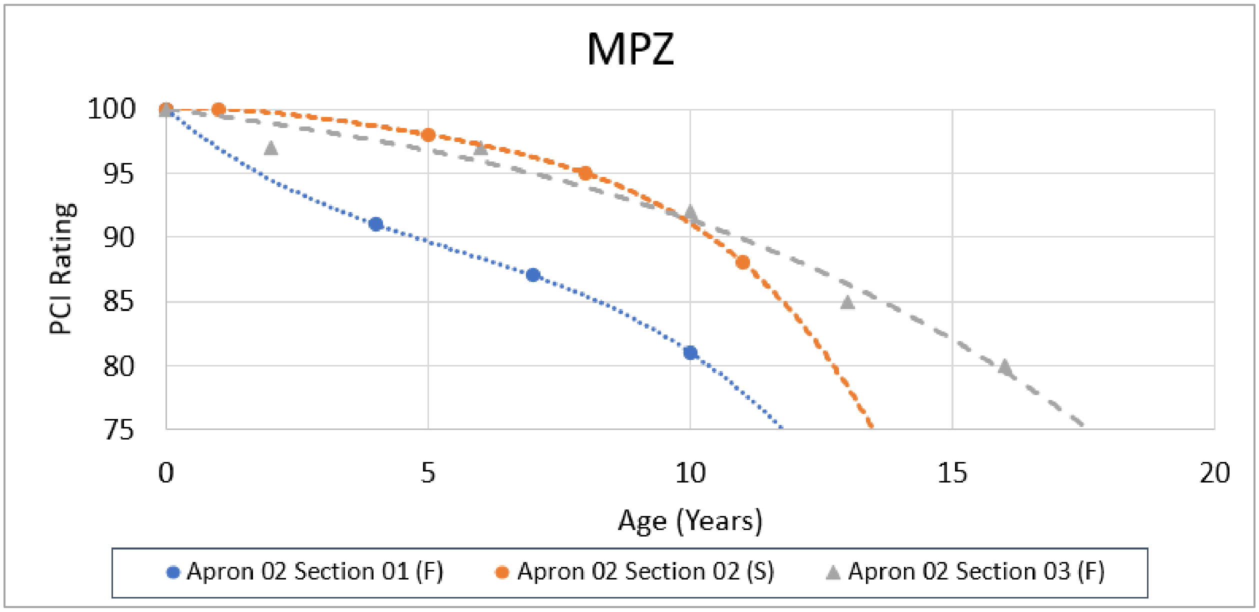

Figure A-6. Apron 02 PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 348
- GA Local: 5,569
- GA Itinerant: 2,784
- Military: 49
- Total Operations: 8,759

Based on the ADIP, Runway 15/33 has the following load rating:

- Single Wheel—12,000 lb
- Double Wheel—16,000 lb

Pavement Condition Evaluation

The 2020 PCIs for Apron 02 Sections 01, 02, and 03 were 81, 80, and 88, respectively. The following distresses were identified: joint seal damage, joint spalling, ASR, faulting, linear crack, shattered slab, small patch, and corner spalls.

A.1.3 Webster City Municipal Airport (EBS)

Ownership: Publicly owned
Owner:City of Webster City
400 2nd St.
Webster City, IA 50595-0217
Phone 515-832-5701
Chairman Arpt Cmsn: Scott Bargfrede
Manager: Mike Luedtke
1524 - 240th St
Webster City, IA 50595
Phone 515-832-3723
Email address: info@stormflyingservice.com

Webster City Municipal Airport (EBS) is located 3 miles southwest of Webster City, in Hamilton County, Iowa. The NPIAS for 2011-2015 categorized it as a GA airport (having at least 10 locally based aircraft). The airport covers 181 acres (73 ha) at an elevation of 1,122 ft (342 m). It has two runways: 14/32, which has a concrete surface and measures 3,851 ft by 75 ft, and 05/23, which has a turf surface and measures 2,663 ft by 90 ft (Figure A-7).

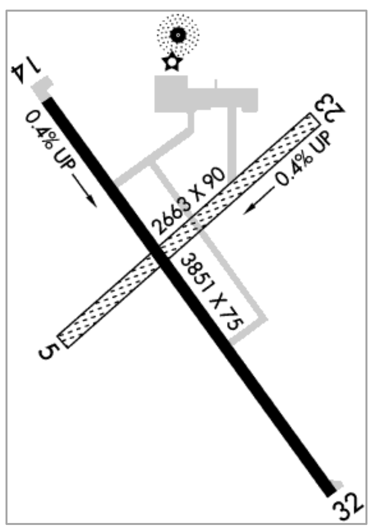

Figure A-7. Webster City Municipal Airport Diagram (source: www.aopa.org)

Overlay of Runway 14/32 and Taxiway 01; New construction of Runway 05/23 and Taxiways 03 and 04

- Runway 05/23 new construction (FAA Specifications)—2000
  - PCN: 5 /R/C/W/U
- Runway 14/32 overlay (State Specifications)—2001
- Taxiway 01 overlay (State Specifications)—2002
- Taxiway 03 new construction (FAA Specifications)—2002
- Taxiway 04 new construction (FAA Specifications)—2002

Specifications and Plans

Plans for this project were not available. FAA specifications were used for Runway 05/23, Taxiway 03, and Taxiway 04. State specifications were used for Runway 14/32 and Taxiway 01.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

For Runway 15/33, no information was available.

Quality Control and Acceptance Results

For Runway 15/33, no information was available.

Pavement Performance Data

Based on the Iowa DOT Pavement Management Reports in 2019:

- Runway 14/32 had a PCI of 89. The following distresses were observed:
  - Low-severity linear crack
  - Low-severity faulting
  - Low-severity joint spalling
  - Medium-severity joint seal damage

- Taxiway 01 had a PCI of 92. The following distresses were observed:
  - Low-severity linear cracking
  - Low- and medium-severity joint spalling
  - Medium-severity joint seal damage

- Runway 05/23 had a PCI of 89. The following distresses were observed:
  - Low-severity linear crack
  - Low-severity joint spalling
  - Medium-severity joint seal damage

- Taxiway 03 had a PCI of 91. The following distresses were observed:
  - Low-severity corner spalling
  - Low-severity faulting
  - Low and medium severity joint spalling
  - Medium-severity joint seal damage

- Taxiway 04 had a PCI of 91. The following distresses were observed:
  - Low-severity faulting
  - Low- and medium-severity joint spalling

– Medium-severity joint seal damage

A plot of the PCI ratings since the most recent construction is shown in Figure A-8.

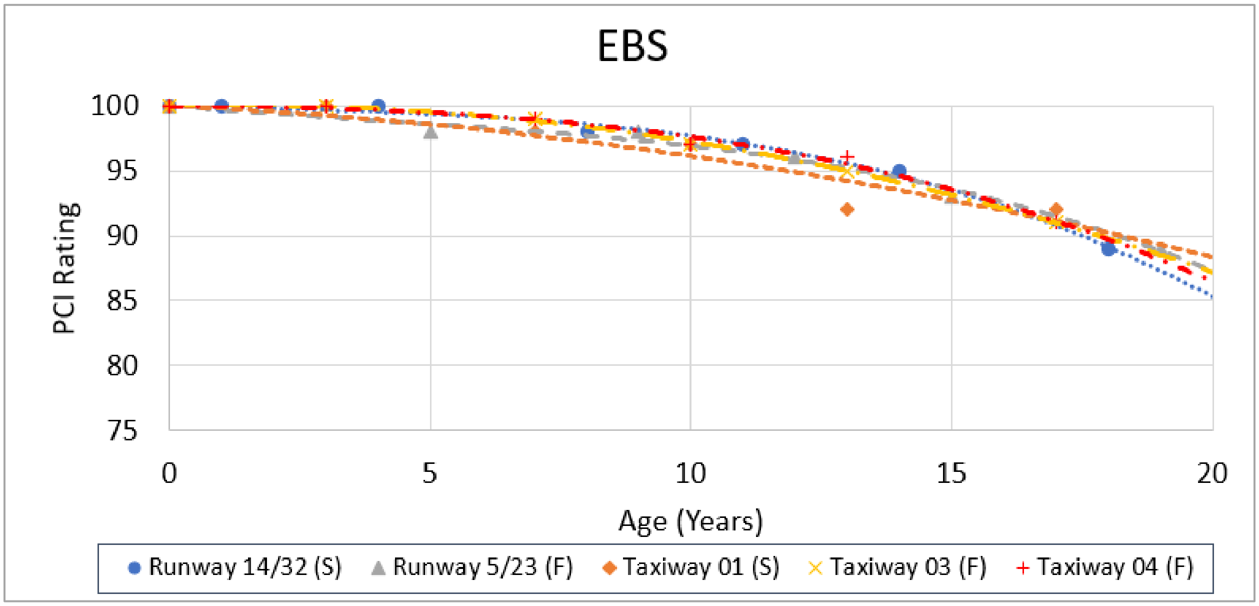

Figure A-8. Webster City Municipal Airport PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 48
- GA Local: 2,062
- GA Itinerant: 1,140
- Military: 0
- Total Operations: 3,250

Based on the ADIP, Runway 14/32 has the following load rating:

- Single Wheel—15,000 lb

Pavement Condition Evaluation

The 2020 PCI for Runway 14/32 was 89, Runway 05/23 was 89, Taxiway 01 was 92, Taxiway 03 was 91, and Taxiway 04 was 91. The following distresses were identified: joint seal damage, joint spalling, faulting, linear crack, and corner spalls.

A.1.4 Ames Municipal Airport (AMW)

Ownership: Publicly owned
Owner: City of Ames
515 Clark Ave
Ames, IA 50010
Phone 515-239-5160
Manager: Damion Pregitzer
515 Clark Ave
Ames, IA 50010
Phone 515-239-5275

Ames Municipal Airport (AMW) is located 2 miles southeast of Ames, in Story County, Iowa. The NPIAS for 2011-2015 categorized it as a GA airport (having at least 10 locally based aircraft). The airport covers 700 acres (283 ha) at an elevation of 956 ft (291 m). It has two runways: 01/19, which has an asphalt surface and measures 5,701 ft by 100 ft, and 13/31, which has a concrete surface and measures 3,491 ft by 75 ft (Figure A-9).

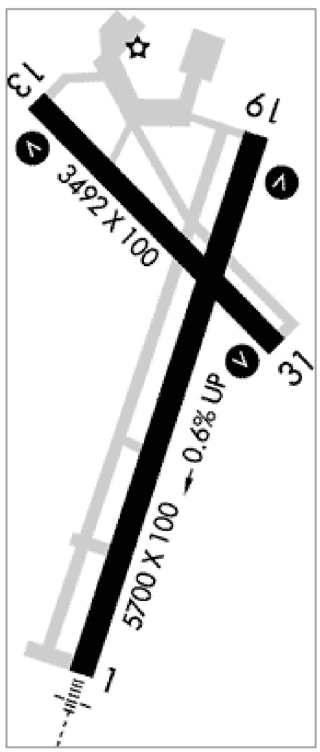

Figure A-9. Ames Municipal Airport Diagram (source: www.aopa.org)

Runway 13/31

- PCN: Not available
- Rehabilitation (FAA Specifications) completed October 2009
- FAA AIP Project No. 3-19-0004-17

Specifications and Plans

A set of construction plans were provided by the airport manager that included geotechnical information and exploration sites, demolition plans, typical sections, runway profiles, and other information. Overall, the plans included a rehabilitation of the pavement for Sections 01 and 04 on the runway. The typical section for the main portion of Runway 13/31 is shown in Figure A-10.

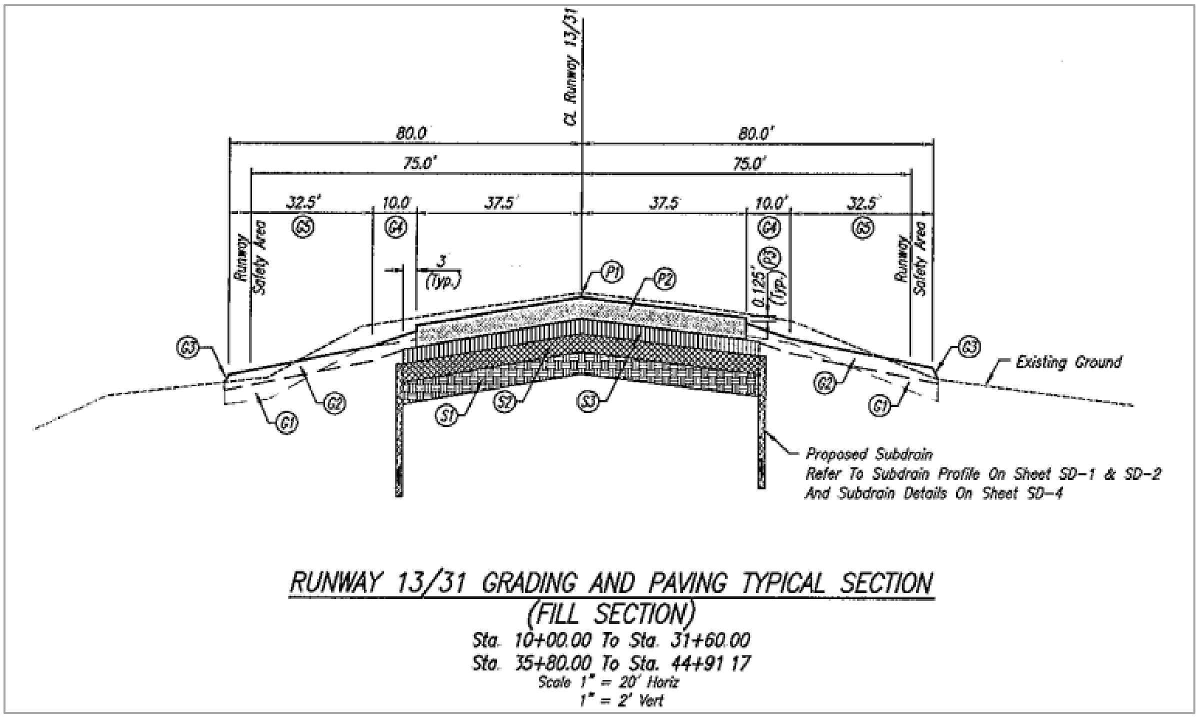

Figure A-10. Runway 13/31 Typical Section

The consultant for the rehabilitation design was HSW.

The following specifications were identified in the provided set of plans:

- ITEM P-101 PAVEMENT REMOVAL—requirements for pavement removal to prevent damage of adjacent or underlying material
- ITEM P-501 PORTLAND CEMENT CONCRETE PAVEMENT—requirements for materials and construction of PCC pavement
- ITEM P-620 PAVEMENT MARKING—requirements for pavement marking material and application

Mix Design

No information on mix design submittals and acceptance criteria were provided.

Construction Report

No information was provided.

Quality Control and Acceptance Results

No information was provided.

Pavement Performance Data

Based on the 2019 Iowa DOT Pavement Management Reports, Sections 01 and 04 of Runway 13/31 had PCIs of 98 and 95, respectively. The following distresses were identified within each section:

- Section 01:
  - Low-severity joint seal damage

- Section 04:
  - Low-severity faulting
  - Low- and medium-severity joint seal damage

A plot of the PCI ratings since the project was completed is shown in Figure A-11.

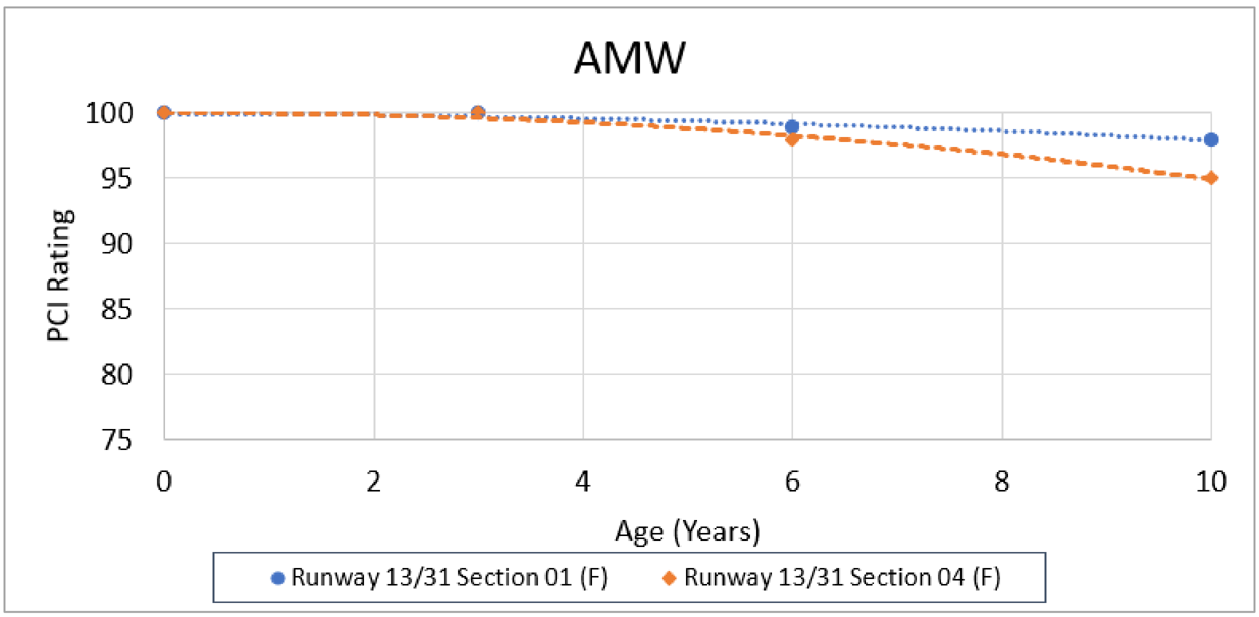

Figure A-11. Ames Municipal Airport Runway 13/31 PCI Rating

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 1,656
- GA Local: 12,639
- GA Itinerant: 18,957
- Military: 499
- Total Operations: 37,751

Based on the ADIP, Runway 13/31 has the following load rating:

- Single Wheel—30,000 lb

Pavement Condition Evaluation

The 2019 PCI for Runway 13/31 for Sections 01 and 04 were 98 and 95, respectively. The following distresses were identified: joint seal damage and faulting.

A.1.5 Fort Dodge Regional Airport (FOD)

Ownership: Publicly Owned
Owner: City of Fort Dodge
819 First Ave. South
Fort Dodge, IA 50501
Phone 515-573-7144
Manager: Ms. Rhonda Chambers
1639 Nelson Ave Suite 2
Fort Dodge, IA 50501
Phone 515-573-3881
Email address: Rchambers@Fortdodgeiowa.org

Fort Dodge Regional Airport (FOD) is located 3 miles north of Fort Dodge, in Webster County, Iowa. The NPIAS for 2011-2015 categorized it as a commercial service airport. The airport covers 967 acres (391 ha) at an elevation of 1,156 ft (352 m). It has two runways: 06/24, which has an asphalt surface and measures 6,547 ft by 150 ft, and 12/30, which has an asphalt surface and dimensions 5,301 ft by 100 ft (Figure A-12).

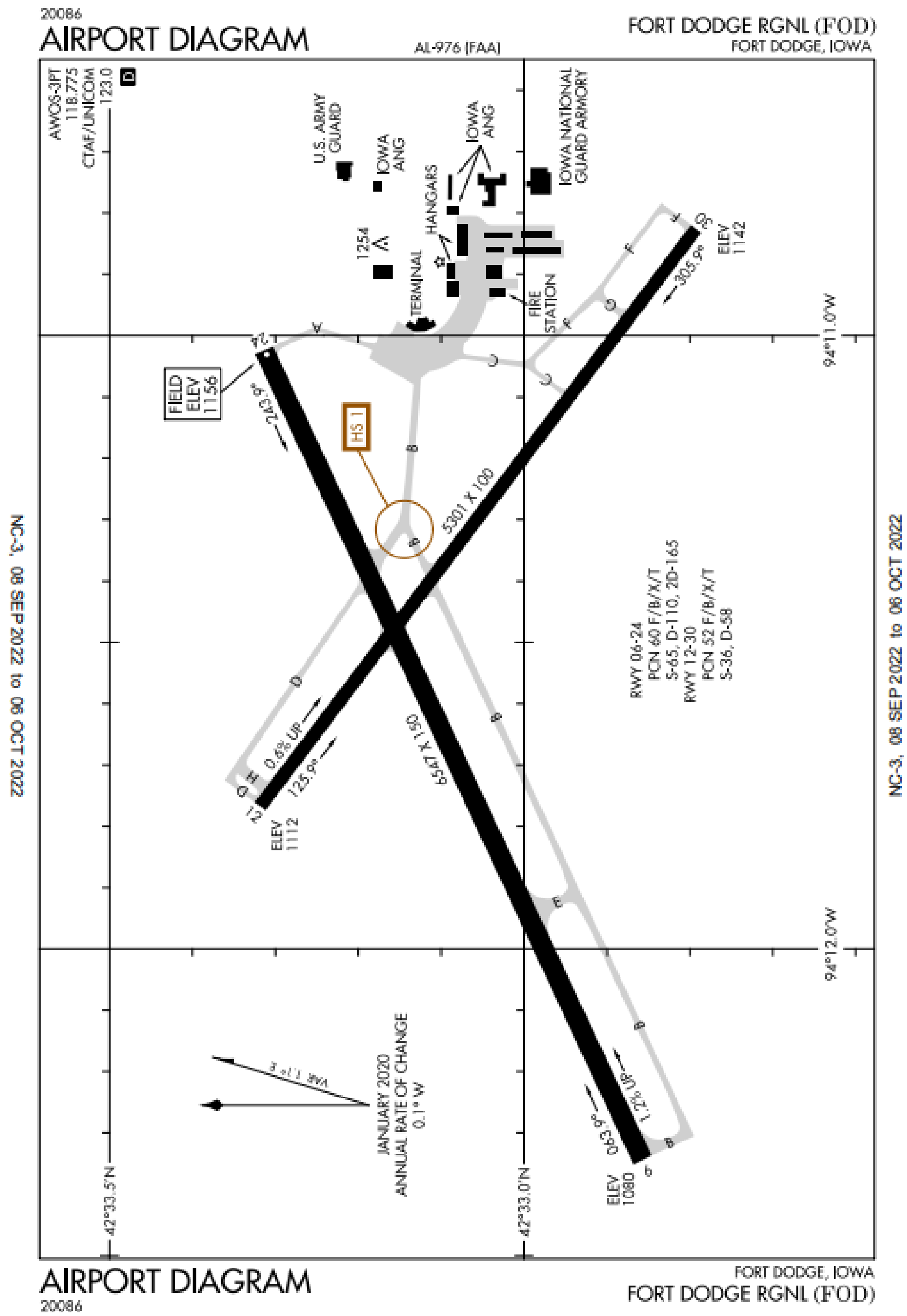

Figure A-12. Fort Dodge Regional Airport Diagram (source: www.aopa.org)

Taxiway C

Reconstruction of Taxiway C (FAA Specifications) was completed August 2001.

Specifications and Plans

Plans for this project were not available. FAA specifications were used.

Mix Design

No information on mix design submittals and acceptance criteria were provided.

Construction Report

No information was provided.

Quality Control and Acceptance Results

No information was provided.

Pavement Performance Data

Based on the 2019 Iowa DOT Pavement Management Reports, the PCI measured in 2019 was 90, and the following distresses were identified: joint spalling, joint seal damage, faulting, and corner break. A plot of the PCI ratings since the project was completed is shown in Figure A-13.

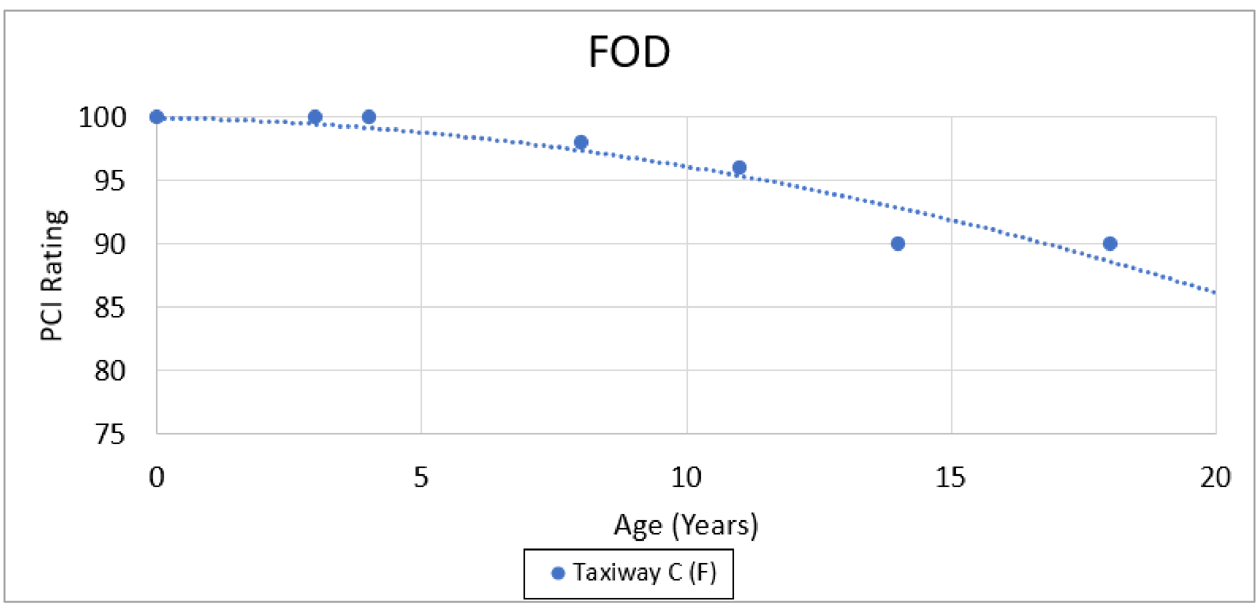

Figure A-13. Fort Dodge Regional Airport Taxiway C PCI Rating

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 1,248
- Air Taxi: 250
- GA Local: 4,000
- GA Itinerant: 5,000
- Military: 100
- Total Operations: 10,598

Based on the ADIP, the runways have the following load rating:

Runway 6/24:

- Single Wheel—65,000 lb
- Double Wheel—110,000 lb
- Double Tandem—165,000 lb

- Runway 12/30:Single Wheel—36,000 lb
- Double Wheel—58,000 lb

Pavement Condition Evaluation

The 2019 PCI for Taxiway C was 90. The following distresses were identified: joint spalling, joint seal damage, corner break, and faulting.

A.1.6 Jefferson Municipal Airport (EFW)

Ownership: Publicly owned
Owner: City of Jefferson
City Hall
Jefferson, IA 50129
Phone 515-386-3111
Manager: Dr. James Forbes
1581 235 ST
Jefferson, IA 50129
Phone (515) 386-3111
Also 515-386-4429 or 515-386-2136 (Police)

Jefferson Municipal Airport (EFW) is located 2 miles east of Jefferson, in Jefferson County, Iowa. The NPIAS for 2011-2015 categorized it as a GA airport (having at least 10 locally based aircraft). The airport covers 200 acres (81 ha) at an elevation of 1,047 ft (319 m). It has two runways: 14/32, which has a concrete surface and measures 4,100 ft by 75 ft, and 18/36, which has a turf surface and measures 1,696 ft by 150 ft (Figure A-14).

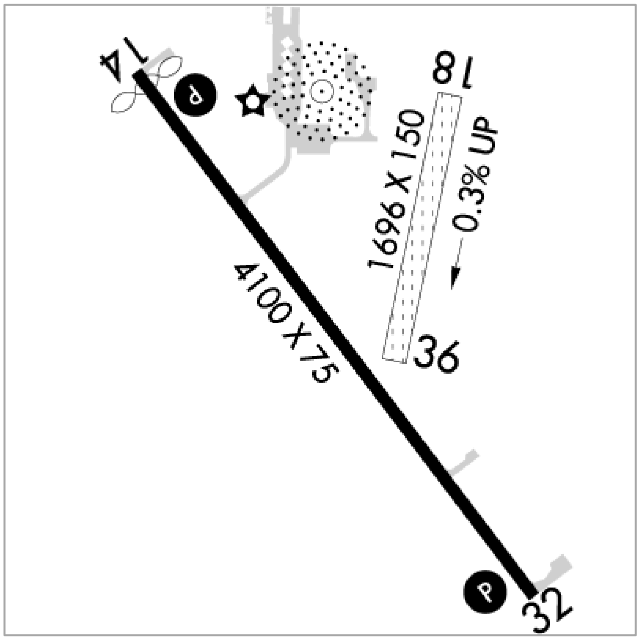

Figure A-14. Jefferson Municipal Airport Diagram (source: www.aopa.org)

Runway 14/32

- Overlay of Section 01 (State Specifications) completed June 2001
- Reconstruction of Section 02 (State Specifications) completed June 2001
- PCN: 6 /R/C/X/T
- FAA AIP Project No. 3-19-0049-01

Specifications and Plans

Plans for this project were not available. State specifications were used.

Mix Design

No information was provided.

Construction Report

No information was provided.

Quality Control and Acceptance Results

No information was provided.

Pavement Performance Data

Based on the 2021 IaDOT Pavement Management Reports, Sections 01 and 02 had PCIs of 78 and 81, respectively. The following distresses were identified within each section:

- Section 01:Shrinkage cracking
- Low- and medium-severity faulting
- Low- and medium-severity linear cracking
- Medium- and high-severity joint seal damage

- Section 02:Low-severity faulting
- Low-severity shattered slab
- Low-severity corner break
- Low- and medium-severity linear cracking
- Medium-severity joint spalling
- Medium-severity corner spalling
- Medium- and high-severity joint seal damage

A plot of the PCI ratings since the project was completed is shown in Figure A-15.

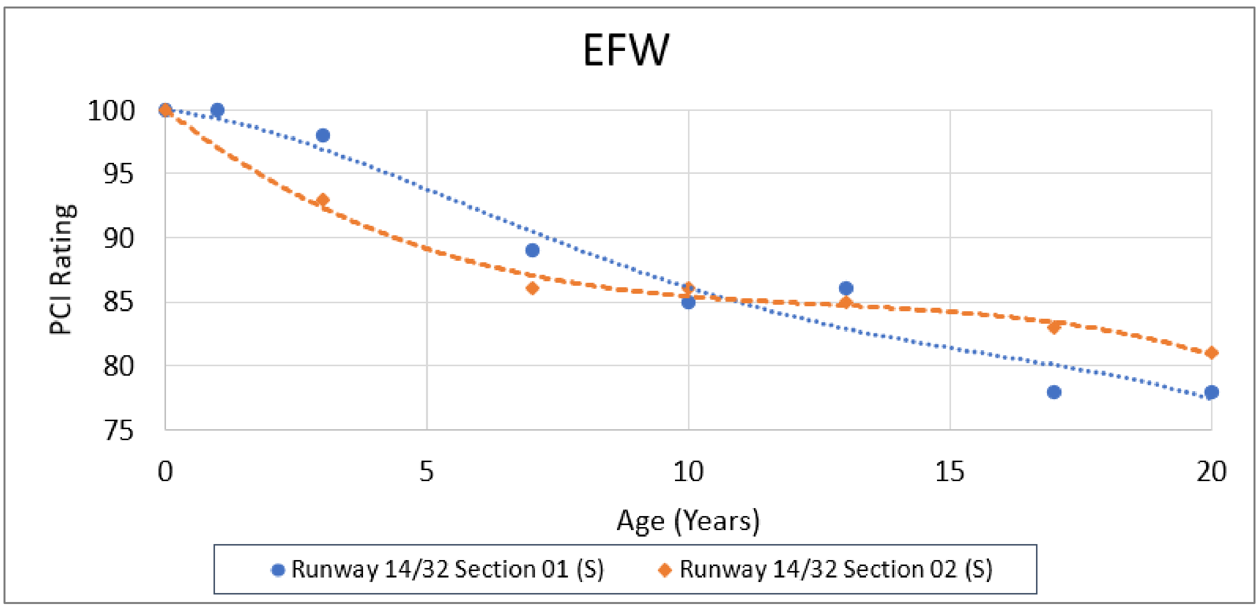

Figure A-15. Jefferson Municipal Airport Runway 14/32 PCI Rating

History of Preventive or Maintenance Activities Conducted on the Airfield

No preventive or maintenance activities have been conducted on the airfield.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 0
- GA Local: 2,825
- GA Itinerant: 2,825
- Military: 100
- Total Operations: 5,750

Based on the ADIP, Runway 14/32 has following load rating:

- Single Wheel—11,000 lb

Pavement Condition Evaluation

The 2021 PCI for Runway 14/32 was 90. The following distresses were identified: joint spalling, joint seal damage, corner break, and faulting.

A.2 MISSOURI

A.2.1 Lee's Summit Municipal (LXT)

Owner: City of Lee's Summit
220 SE Green, P.O. Box 1600
Lee's Summit, MO 64063
Phone: 816-969-1000
Manager: John Ohrazda
2751 NE Douglas Rd
Lee's Summit, MO 64064
Phone: 816-969-1800

Lee's Summit Municipal Airport (LXT) is located 3 miles north of Lee's Summit, Missouri. The NPIAS categorizes it as a GA reliever airport. The airport covers 486 acres at an elevation of 1,004 ft. It has two concrete runways: 18/36, which is 5,501 ft by 100 ft, and 11/29, which is 4,000 ft by 75 ft (see Figure A-16).

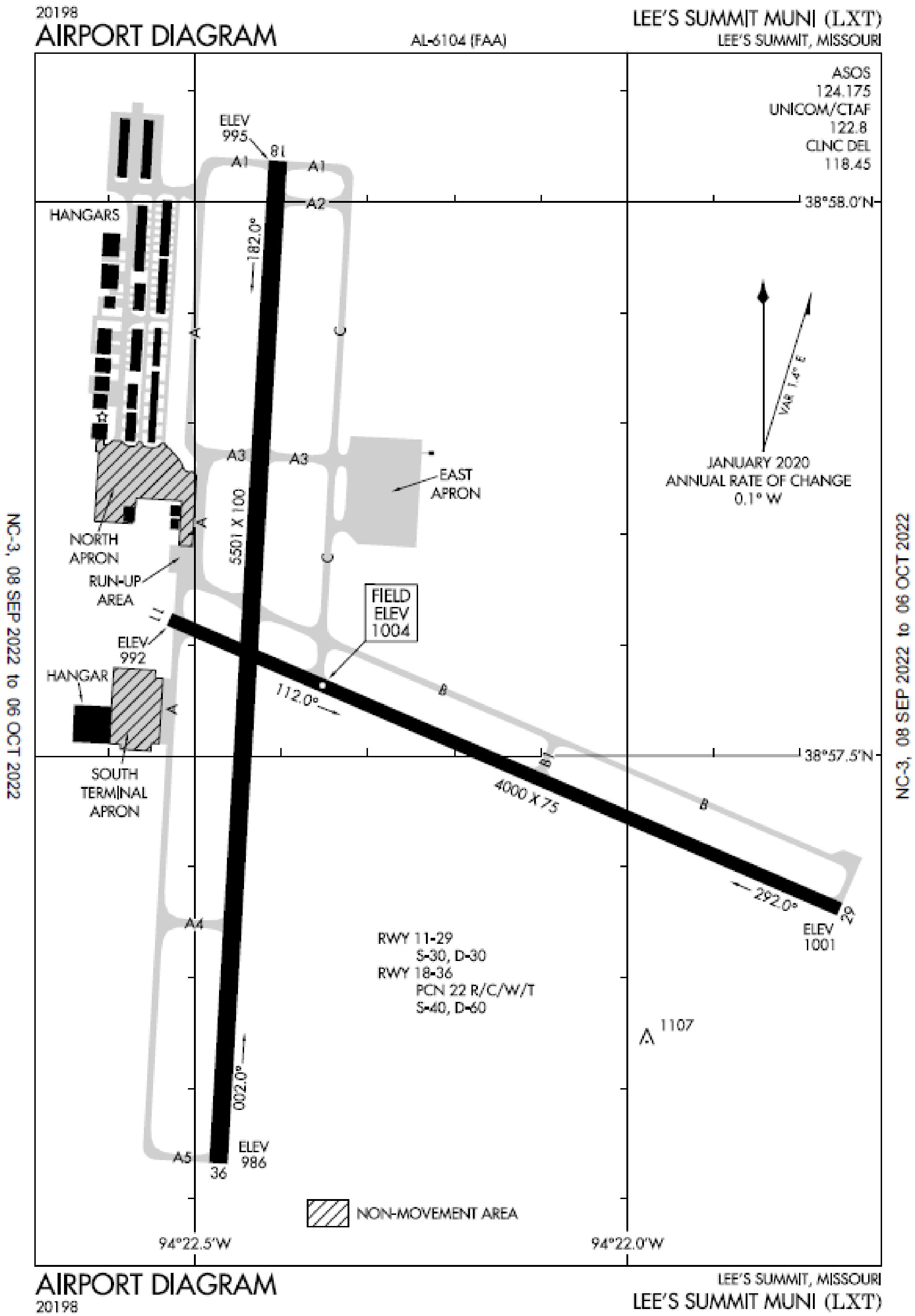

Figure A-16. Lee's Summit Municipal Airport (source: adip.faa.gov)

Runway 18/36

- Pavement Classification Number (PCN): 22/R/C/W/T
- Reconstruction of Runway 18/36 (State Specifications) was completed in 2017
- Project No: AIR 156-109A-3

Runway 11/29

- Reconstruction of Runway 11/29 (FAA Specifications) was completed in 2017
- Project No: 15-109A-3

Taxiway C

- Reconstruction of Taxiway C (FAA Specifications-Section 20) was completed in 2017
- Project No: 15-109A-3
- Reconstruction of Taxiway C (State Specifications-Section 10) was completed in 2010
- Project No: 07-109A1 and 07-109A2

East Apron

- Reconstruction of East Apron (State Specifications) was completed in 2010
- Dimensions: 590 ft × 390 ft
- Project No: 07-109A1 and 07-109A2

Specifications and Plans

Runway 18/36

A set of construction plans was acquired for 2017 construction work that included geotechnical information and exploration sites, demolition plans, typical sections, runway profiles and other information. Overall, the plans included an extension and widening of Runway 18/36; the pavement consisted of a 9-in. PCC over a 6-in. crushed aggregate base. The typical section for the main portion of Runway 18/36 is shown in Figure A-17.

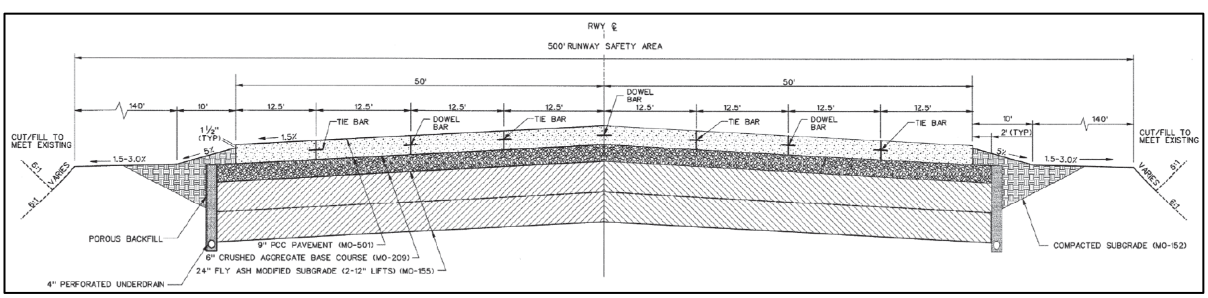

Figure A-17. Runway 18/36 Typical Section

The consultant for this project was Crawford Murphy & Tilly, Inc., in St. Louis, Missouri.

The following specifications were extracted from project documents and are applicable to all of the construction at LXT:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.

- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.

- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.

- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

<u>Runway 11/29 and Taxiway C (Section 20)</u>

The construction plans include construction safety notes, safety plan, work area plans, demolition plans, typical sections, sequencing of construction, runway profiles, and other information. Overall, these projects included an extension of the west end of Runway 11/29 and a part of Taxiway C. A 9-in. PCC over a 6-in. crushed aggregate base was proposed. A 6-in. PCC over a 6-in. crushed aggregate base was constructed for another part of Runway 11/29. Figure A-18 shows the typical section for the extension of Runway 11/29.

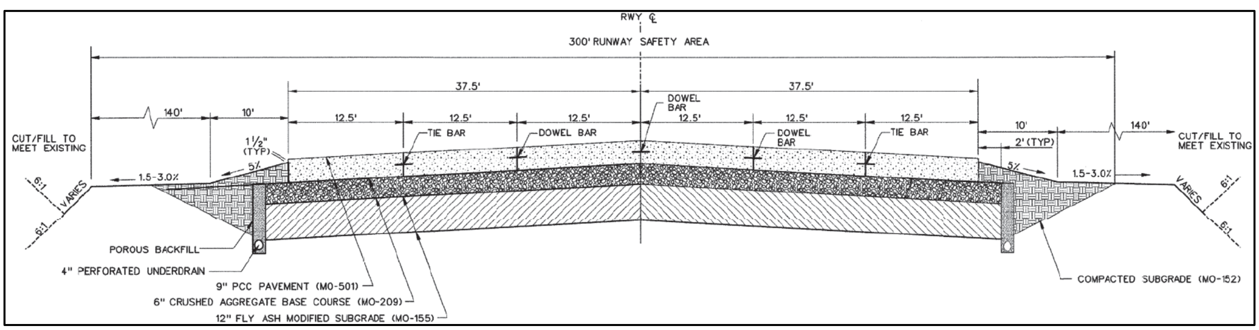

Figure A-18. Runway 11-29 Typical Section

The consultant for this project was Crawford Murphy & Tilly, Inc., in St. Louis, Missouri.

<u>East Apron and Taxiway C (Section 10)</u>

The construction plans included a construction activity plan, demolition plans, typical sections, earth work plan, slab layout plan, and other information. Overall, the plans included a new terminal apron and taxiway. The proposed pavement was 9 in of PCC over a 6-in. crushed aggregate base. Figure A-19 shows the typical section for Taxiway C.

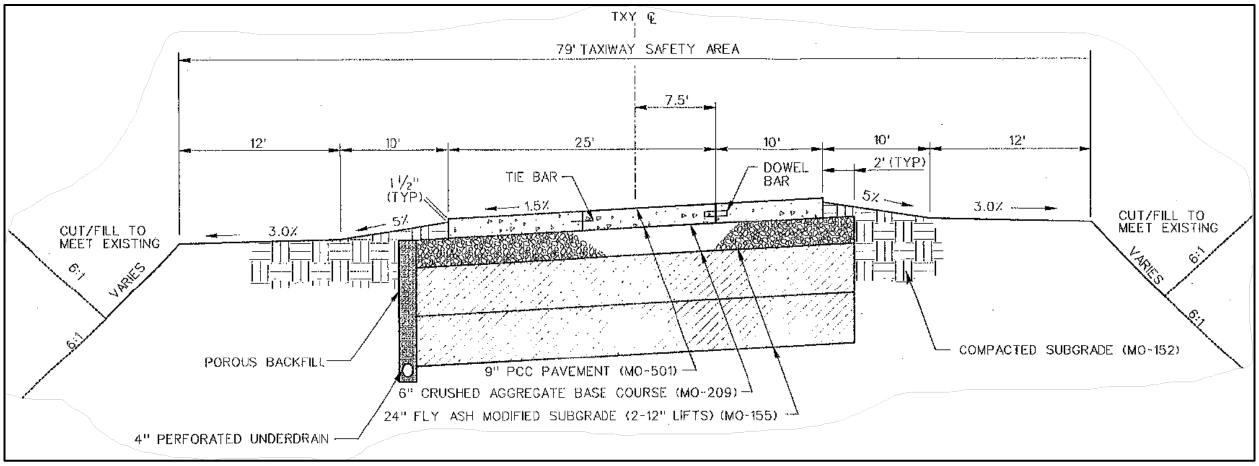

Figure A-19. Taxiway C Typical Section

The consultant for this project was Crawford, Murphy & Tilly, Inc., in St. Louis, Missouri.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, schedule, notations, delays, or other items was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2019 Pavement Management Reports, the average PCI for both runways was 100, with no distresses noted. Also from the 2019 inspection, the PCI was 100 for Taxiway C Sections 20 and 89 for Taxiway C Section 10. A PCI of 99 was reported for the East Apron. The most prevalent types of distress throughout the east apron and Taxiway C were low- to high-severity joint seal damage. Taxiway C performance over time is reflected in Figure A-20.

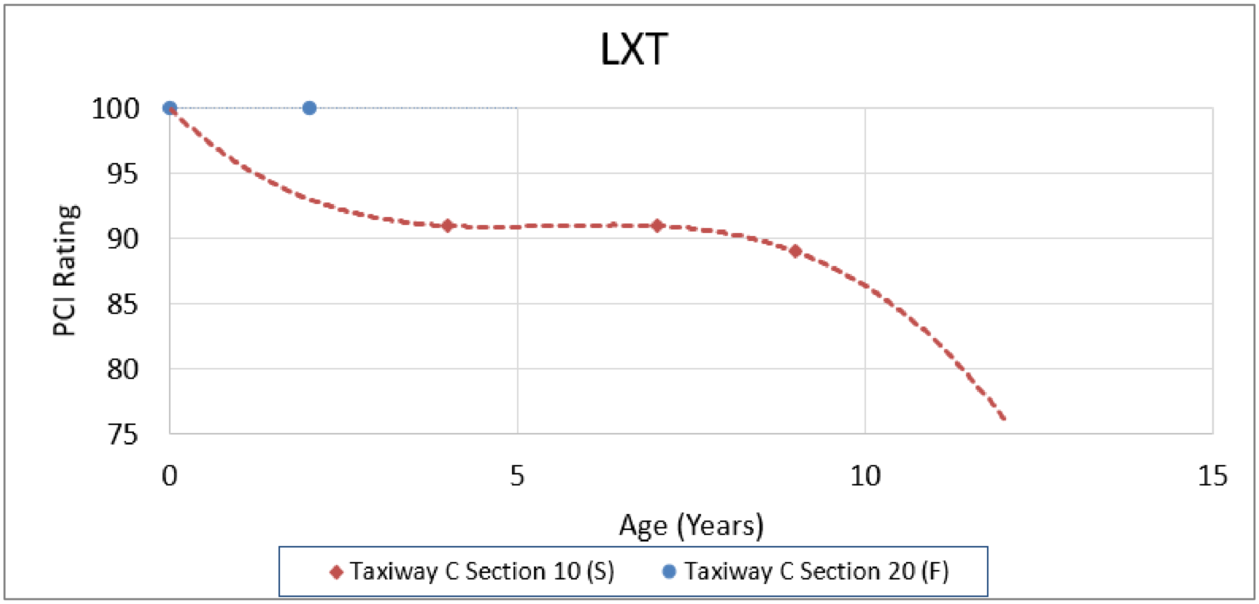

Figure A-20. Taxiway C Performance Over Time

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since the project was completed.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 1,750
- GA Local: 34,850
- GA Itinerant: 15,150
- Military: 750
- Total Operations: 52,500

Based on the ADIP, Runway 18/36 and 11/29 are rated for the following loads:

- Runway 18/36:
  - Single Wheel—40,000 lb
  - Dual Wheel—60,000 lb

- Runway 11/29:
  - Single Wheel—30,000 lb
  - Dual Wheel—30,000 lb

A.2.2 Eldon Model Airpark (H79)

Owner: City of Eldon
101 South Oak St Box 355
Eldon, MO 65026
Phone: 573-392-2291
Manager: Jennifer Vernon
101 South Oak St Box 355
Eldon, MO 65026
Phone: 573-557-2373

The Eldon Model Airpark is a publicly owned GA airport in Miller County, Missouri. The airport covers an area of 138 acres and is at an elevation of 917 ft. It has a concrete runway, 18/36, which is 4,000 ft by 75 ft (Figure A-21).

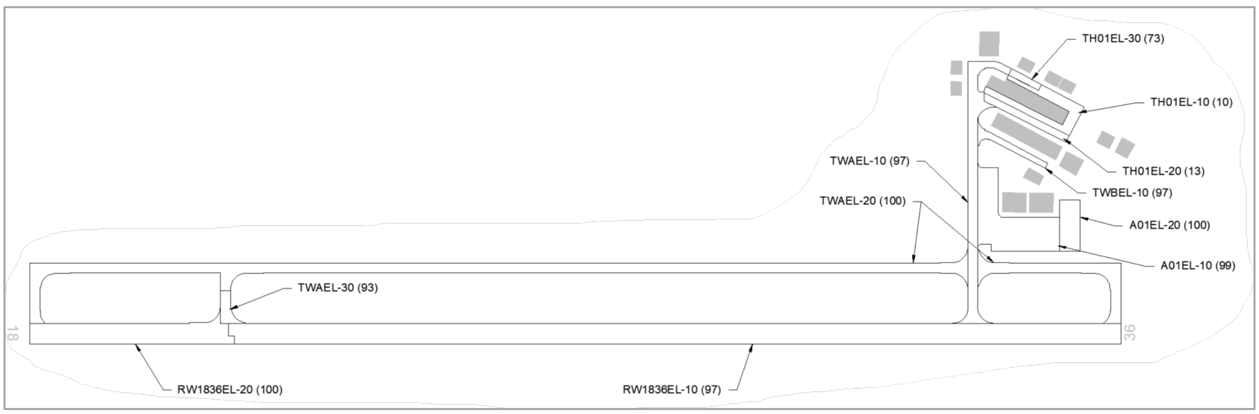

Figure A-21. Eldon Model Airpark Airport Diagram (source: APTech)

Runway 18/36

- PCN: Not available
- Construction of Runway 18/36 (FAA Specifications-Section 10) completed in 1995
  - Project Number: Not available
- Extension of Runway 18/36 (State Specifications-Section 20) completed in 2010
  - Project Number: 08-046A-2

Taxiway A

- Construction of Taxiway A (FAA Specifications-Sections 10 and 30) completed in 1995
  - Project Number: Not available
- Reconstruction of Taxiway A (State Specifications-Section 20) completed in 2010
  - Project Number: 08-046A-2

Specifications and Plans

Runway 18/36 and Taxiway A

A set of construction plans was acquired for the 1995 and 2010 projects, which included demolition plans, typical sections, runway profiles, and other information. The 1995 plans cover construction of Runway 18/36 and Taxiway A with slab layout. For the 2010 extension, safety plans, demolition plans, a site plan, and profiles, along with typical section and slab layouts for both the runway and taxiway are available. A 6-in. PCC surface over a 4-in. crushed aggregate base was proposed. Figure A-22 shows the typical section for the Runway 18/36 extension.

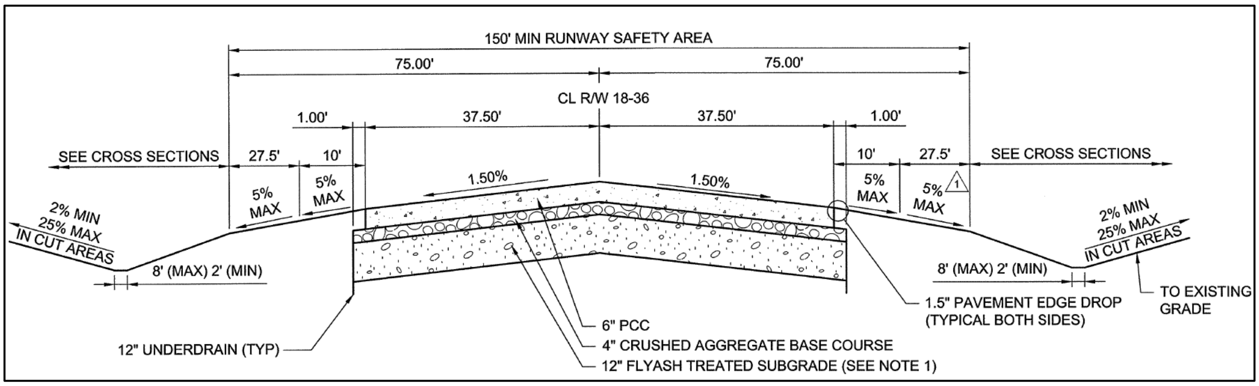

Figure A-22. Runway 18-36 Extension Typical Section

The consultants for these projects were CRD Campbell, Inc., in St. Louis, Missouri (1995) and Burns & McDonnell, Kansas City, Missouri (2010).

The following state specifications were extracted from the project specifications:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly-ash treated subgrade.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, schedule, notations, delays, or other items, was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2021 Pavement Management Reports, the two sections of Taxiway A constructed with FAA specifications (Sections 10 and 30) had PCIs of 93 and 86, while the Taxiway A section constructed with state specifications (Section 20) had a PCI of 93. The reported PCI for Sections 10 and 20 of Runway 18/36 were 87 and 92, respectively. The distresses observed on the runway included medium- to high-severity joint seal damage (Section 10) and medium-severity joint seal damage (Section 20). The distresses observed on the taxiway were low- to medium-severity joint seal damage. The performance of these sections over time is shown in Figure A-23.

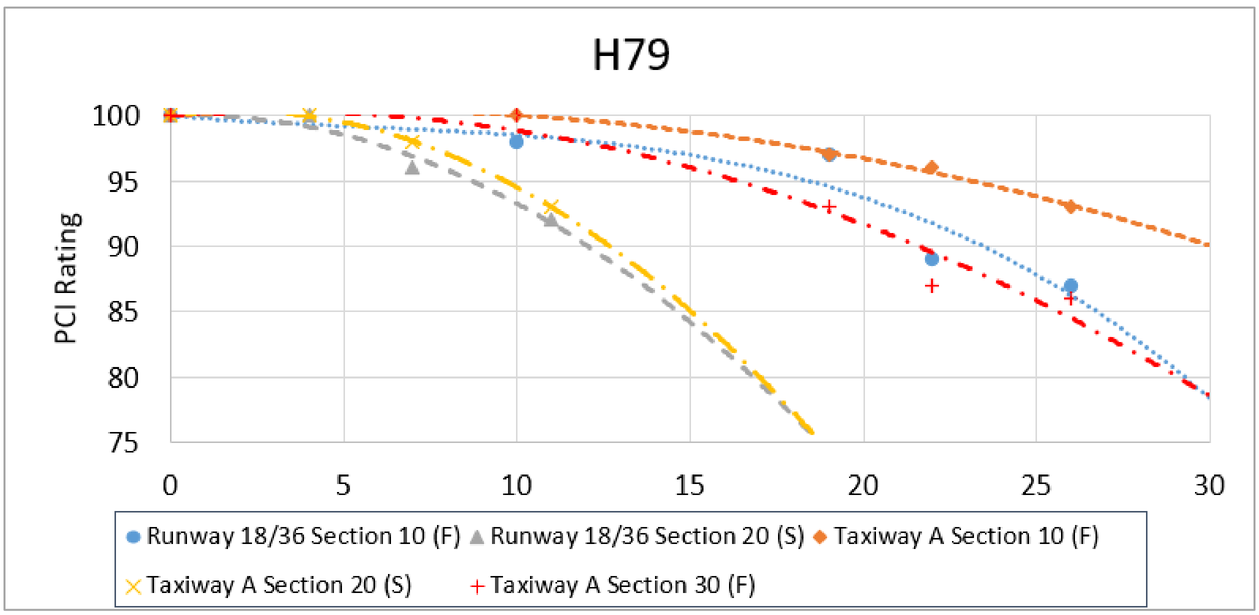

Figure A-23. Eldon Model Airpark Pavement Performance

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

The overall airport traffic operations per year according to the ADIP are as follows:

- Air Carrier: 0
- Air Taxi: 50
- GA Local: 4,000
- GA Itinerant: 6,240
- Military: 72
- Total Operations: 10,362

Based on the ADIP, Runway 18/36 is rated for Single Wheel Load—30,000 lb.

A.2.3 Macon-Fower Memorial Airport (K89)

Owner: City of Macon
106 W. Bourke Street, P.O. Box 569
Macon, MO 63552
Phone: 660-385-6421
Manager: Dave Coleman
1001 Patton St
Macon, MO 63552
Phone: 660-385-6208

Macon-Fower Memorial is a publicly owned GA airport located in Macon County, Missouri. It covers an area of 94 acres and has an elevation of 878 ft. It has a concrete runway, 02/20, with a length of 4,150 ft and a width of 75 ft (Figure A-24).

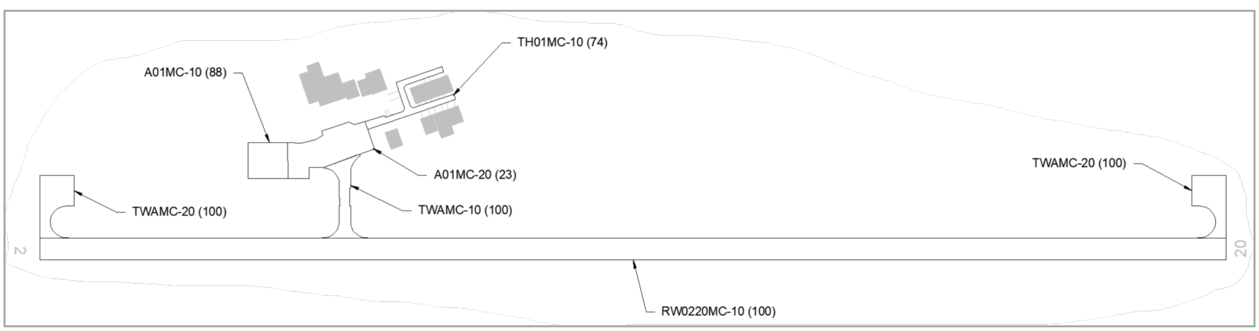

Figure A-24. Macon-Fower Memorial Airport Diagram (source: APTech)

Runway 02/20

- PCN: Not available
- Reconstruction of Runway 2/20 (State Specifications) completed in 2013
  - Project Number: 10-31A-1C

Taxiway A

- Reconstruction of Taxiway A (State Specifications-Sections 10 and 20) completed in 2013
  - Project Number: 10-31A-1C

Specifications and Plans

A set of construction plans was acquired for the 2013 construction. These plans included geotechnical information, demolition plans, typical sections, runway profiles, and other information. A 6-in. PCC over a 6-in. crushed aggregate base was proposed for both the Runway (see Figure A-25) and Taxiway.

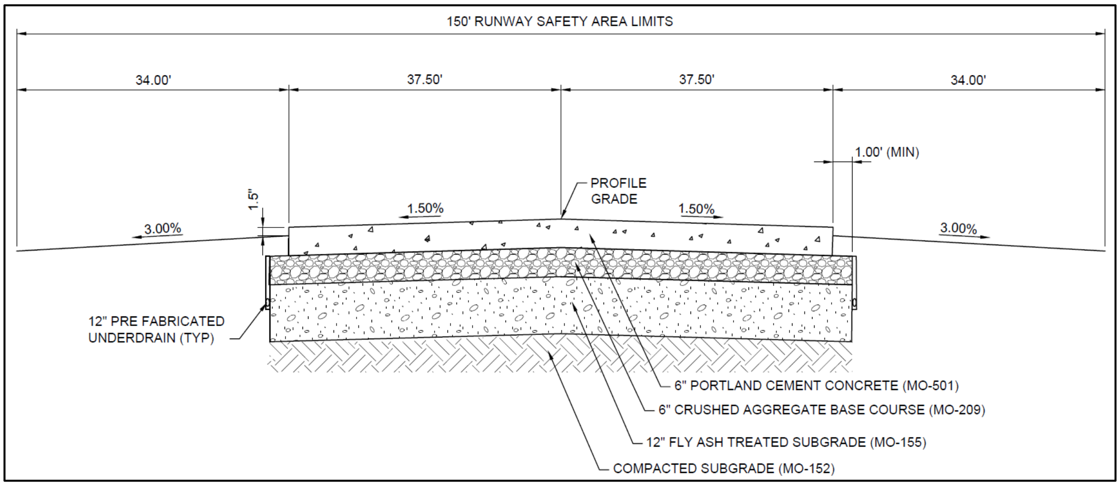

Figure A-25. Runway 02-20 Typical Section

The consultant for this project was Burns & McDonnell, in Kansas City, Missouri.

The following state specifications were extracted from the project specifications:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.
- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, schedule, notations, delays, or other items was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on 2021 Pavement Management Reports, the PCI for Runway 2/20 was 95 and for Taxiway A (Sections 10 and 20) it was 98, as shown in Figure A-26. Low- to medium-severity joint seal damage accompanied by low-severity faulting was reported on these pavements.

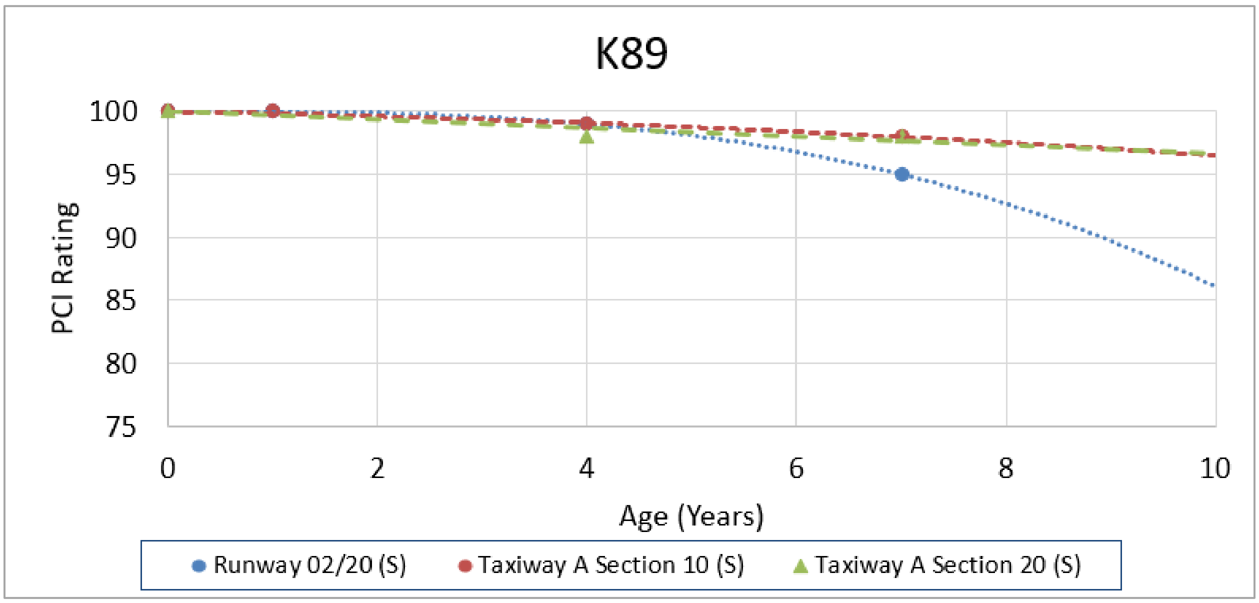

Figure A-26. Macon-Fower Memorial Airport Pavement Performance

History of Preventive or Maintenance Activities Conducted on the Airfield

No information about preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 210
- GA Local: 1,770
- GA Itinerant: 3,024

- Military: 20
- Total Operations: 5,024

Based on the ADIP, Runway 2/20 is rated for Single Wheel Load—12,500 lb.

A.2.4 Branson West Municipal-Emerson Field (FWB)

Owner: City of Branson West
P.O. Box 2229
Branson West, MO 65737
Phone: 417-272-3313
Manager: City of Branson West
393 Aero Drive
Branson West, MO 65737
Phone: 417-272-3921

Branson West Municipal-Emerson Field is a publicly owned GA airport located in Stone County, Missouri. The airfield covers an area of 303 acres (122.62 ha) with an elevation of 1,348 ft above mean sea level. It has one runway designated 03/21 with a concrete surface measuring 5,002 ft by 75 ft (Figure A-27).

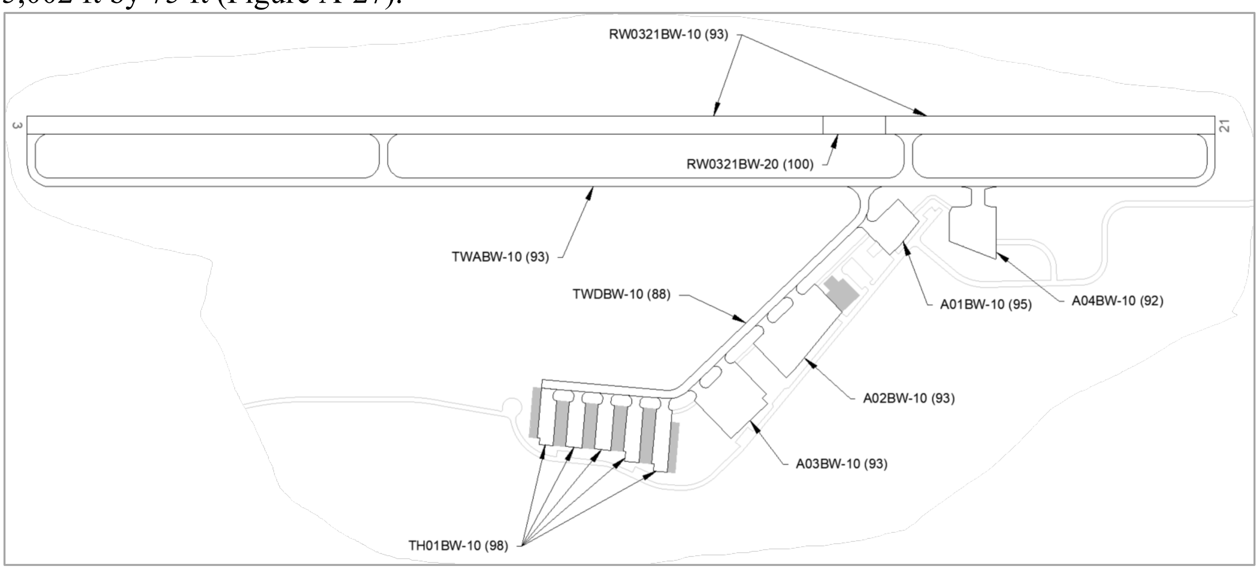

Figure A-27. Branson West Municipal-Emerson Field Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Runway 03/21

- PCN: Not available
- Reconstruction of Runway 03/21 (State Specifications) completed in 2009

Taxiway A; Taxiway D; T-Hangar 1; Apron 1, 2 and 3

- Reconstruction of Taxiways A and D; T-Hangar 1; and Aprons 1, 2, and 3 (State Specifications) completed in 2009

Apron 4

- Construction of Apron 4 (FAA Specifications) completed in 2015
  - Project Number: 13-099A-1

Specifications and Plans

Runway 3/21, Taxiway A, D, T-Hangar 1, Apron 1, 2, and 3

A set of construction plans was acquired for the 2009 construction, which included slab layout plans, typical sections, runway profiles, and other information. A 6-in. PCC surface over a 4-in. crushed aggregate base was proposed for the runway, taxiway, T-hangar, and apron. The typical section for the runway is shown in Figure A-28.

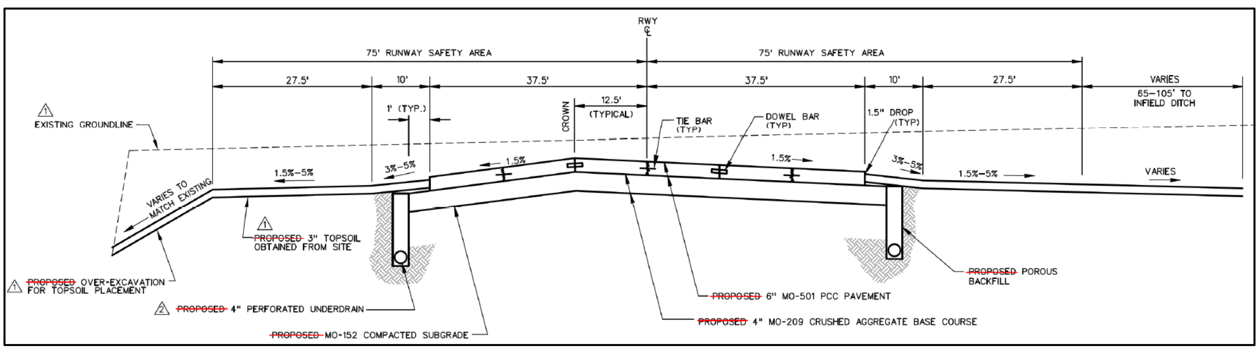

Figure A-28. Runway 03/21 Typical Section

The consultant for this project was Crawford Murphy & Tilly, Inc., in St. Louis, Missouri.

The following state specifications were extracted from the project specifications:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.

- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.

- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

Apron 4

The construction plans for the work conducted in 2015 for Apron 4 included the demolition plan, slab layout plan, typical sections, and other information. A 6-in. PCC surface over a 4-in. crushed aggregate base was proposed for the apron (Figure A-29).

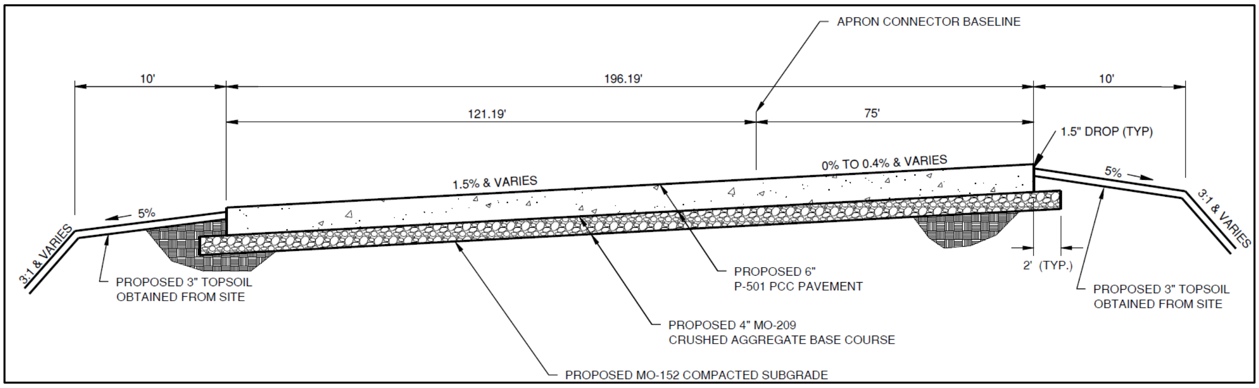

Figure A-29. Apron 4 Typical Section

The consultant for this project was Crawford, Murphy & Tilly, Inc., in St. Louis, Missouri.

The following FAA specifications were extracted from the project specifications:

- P-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

The contractor for the 2015 construction work was Emery Sapp & Sons, Inc., from Springfield, Missouri. The notice to proceed was given on September 19, 2014, and construction started on September 22, 2014. The project was completed on April 21, 2015. The final cost of the project was $428,911.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Using the 2019 Pavement Management Reports, the change in PCI for different sections of runway, taxiway, and apron are plotted in Figure A-30. For sections constructed in 2009, the lowest PCI in 2019 was on Taxiway D (PCI = 88) and the highest was on the T-Hangar 1 pavement (PCI = 98). The PCI of Runway 3/21 was 93. Apron 4 (constructed in 2015) had a PCI of 92 in 2019. The major distresses reported for the runway, taxiway, apron, and T-hangar are low- to high-severity joint seal damage and low-severity faulting.

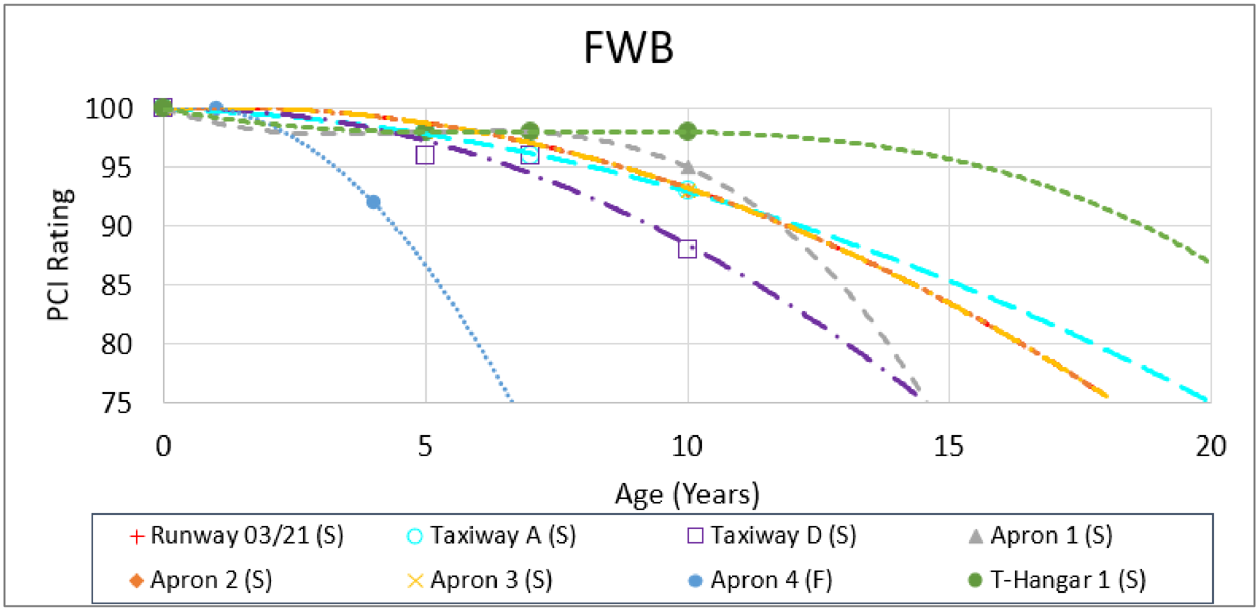

Figure A-30. Branson West Municipal-Emerson Field PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 250
- GA Local: 1,830
- GA Itinerant: 2,061
- Military: 120
- Total Operations: 4,261

Based on the ADIP, Runway 03/21 is rated for Single Wheel Load—30,000 lb.

A.2.5 Sedalia Regional (DMO)

Owner: City of Sedalia
200 S. Osage
Sedalia, MO 65301
Phone: 660-827-3000
Manager: Derrick Dodson
1900 E. Booneville
Sedalia, MO 65301
Phone: 660-851-7650

Sedalia Regional is a publicly owned GA airport located in Pettis County, Missouri. It covers an area of 507 acres (205 ha) at an elevation of 910 ft above mean sea level. It has two runways:: Runway 18/36 is the concrete-surfaced pavement and it measures 5,500 ft by 100 ft (Figure A-31).

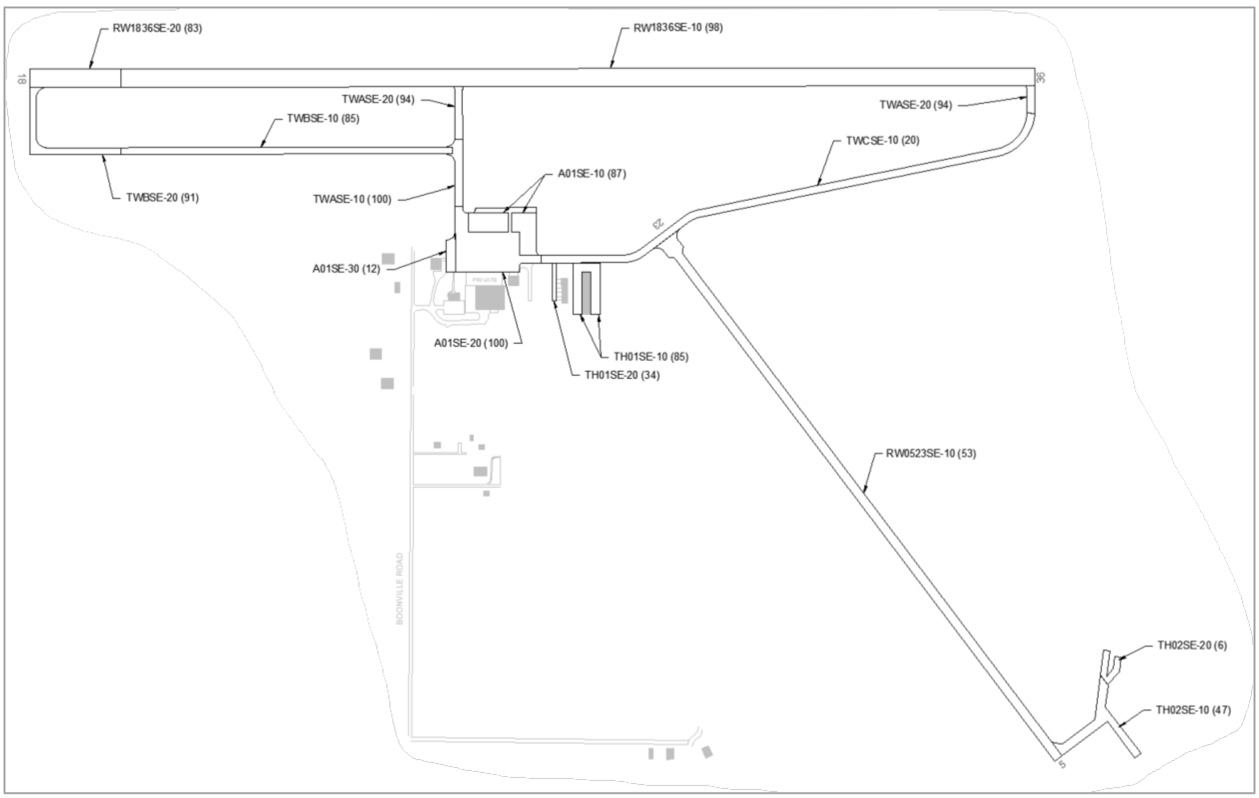

Figure A-31. Sedalia Regional Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Runway 18/36

- PCN: 17/R/C/W/T
- Construction of Runway 18/36 (FAA Specifications-Section 20) completed in 2004
- Reconstruction of Runway 18/36 (State Specifications-Section 10) completed in 2014

- Project Number: 10-020A-1

Taxiway A

- Reconstruction of Taxiway A (State Specifications-Section 20) was completed in 2014
- Project Number: 10-020A-1
- Reconstruction of Taxiway A (FAA Specifications-Section 10) was completed in 2016
- Project Number: 15-020A-1

Specifications and Plans

A set of construction plans was acquired for this 2014 project, which included the demolition plan, runway construction plan, slab layout plan, typical sections, runway profiles, earthwork plans, and other information. An 8-in. PCC over a 6-in. crushed aggregate base was proposed for the runway (Figure A-32). The 2016 reconstruction plans for the taxiway included the plan for demolition, typical sections, slab layout plans, and other information. The taxiway project also consisted of an 8-in. PCC surface over a 6-in. crushed aggregate base course (Figure A-33). No records for the 2004 construction of the runway were found.

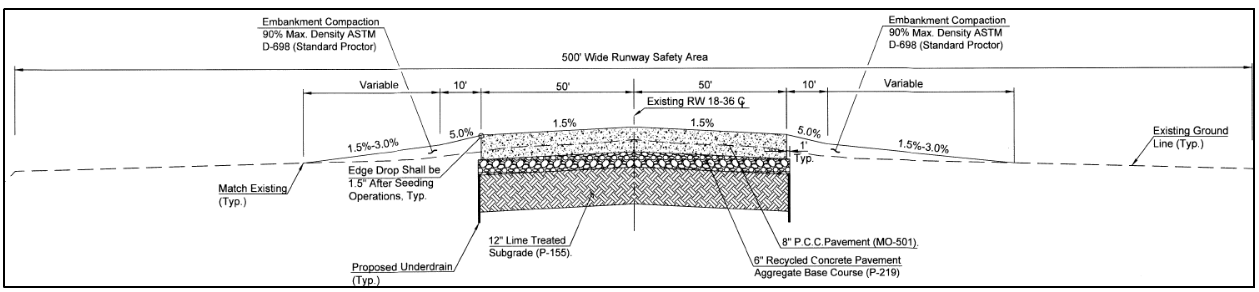

Figure A-32. Runway 18/36 Typical Section

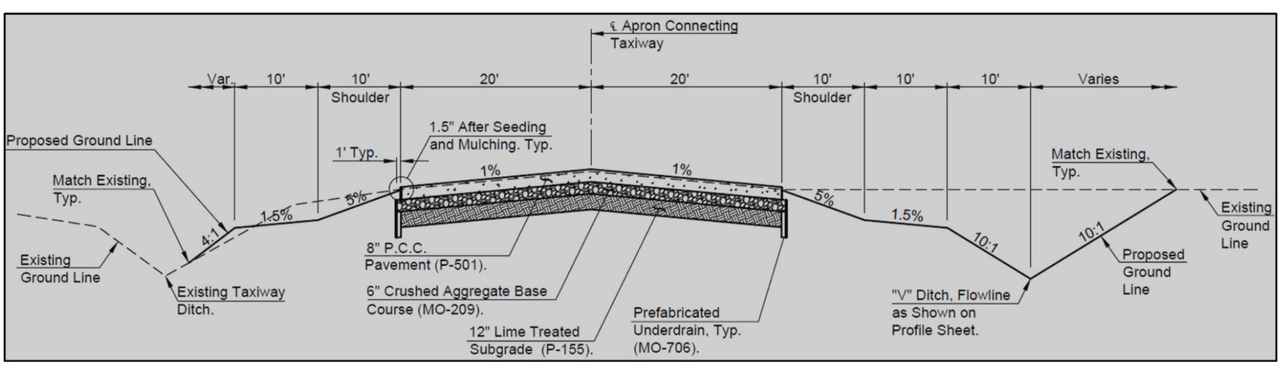

Figure A-33 Taxiway A Typical Section

The consultant for this project was Lochner, in Kansas City, Missouri (2014 and 2016).

The following state specifications were extracted from the project specifications:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-706—specifies materials, construction, method of measurement, and basis of payment for prefabricated underdrains.

The following FAA specifications were applied:

- P-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- P-155—specifies materials, composition, weather limitations, equipment, construction methods, method of measurement, and basis of payment for lime-treated subgrade.
- P-219—specifies materials, construction methods, method of measurements, and basis of payment for recycled concrete aggregate base course.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, schedule, notations, delays, etc. was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2019 Pavement Management Reports, the change in PCI for different sections of runway, taxiway, and apron are plotted in figure A-34. For sections constructed in 2014, the lowest PCI in 2019 was Taxiway A Section 20 (PCI = 94) and the highest was Runway 18/36 Section 10 (PCI = 98). For Runway 18/36 Section 10, constructed in 2004, the reported PCI was 83. For Taxiway A Section 10, reconstructed in 2016, the PCI was 100. The most prevalent types of distress throughout the runway included low- to high-severity joint seal damage along with low- to medium-severity linear cracking. For Taxiway A, reconstructed in 2014, low- to medium-severity joint seal damage along with low-severity ASR were observed.

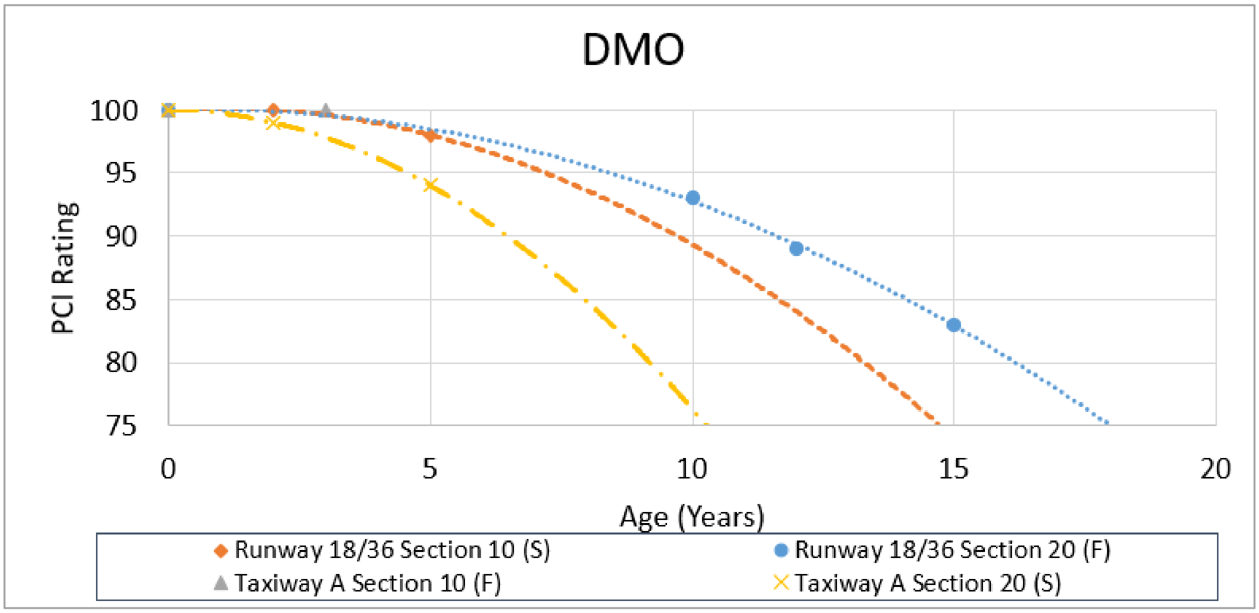

Figure A-34. Sedalia Regional Airport PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 0
- GA Local: 3,850
- GA Itinerant: 4,400
- Military: 2,750
- Total Operations: 11,000

Based on the ADIP, Runway 5/23 and 18/36 are rated for the following loads:

- Runway 5/23:
  - Single Wheel—19,000 lb
- Runway 18/36:
  - Single Wheel—50,000 lb
  - Dual Wheel—65,000 lb

A.2.6 Omar N. Bradley (MBY)

Owner: City of Moberly
101 W. Reed
Moberly, MO 65270
Phone: 660-263-4420
Manager: Tom Sanders
City Hall 101 W. Reed
Moberly, MO 65270
Phone: 660-269-8705

The Omar N. Bradley Airport is a public GA facility located in Randolph County, Missouri. It covers an area of 285 acres (115.34 ha) at an elevation of 867 ft. It has two concrete runways: 05/23 (3,350 ft × 60 ft) and 13/31 (5,001 ft × 75 ft), as shown in Figure A-35.

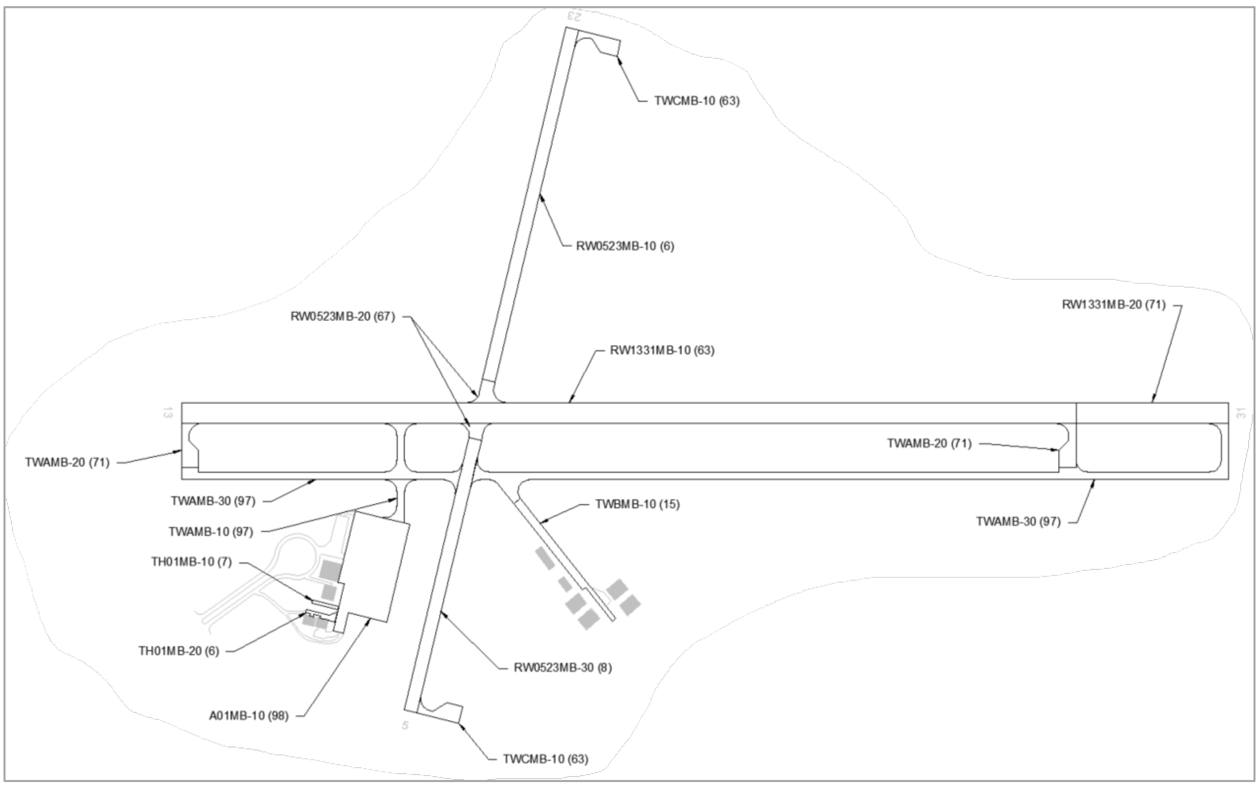

Figure A-35. Omar N. Bradley Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Taxiway A

- Construction of Taxiway A (FAA Specifications-Section 30) completed in 2009
  - Project Number: 07-34A-2 & 3
- Reconstruction of Taxiway A (State Specifications-Section 10) completed in 2012
  - Project Number: 10-34A-1

Specifications and Plans

A set of construction plans was acquired for the 2009 construction of Taxiway A, which included the safety plan, demolition plan, parallel taxiway plan and profile, slab layout plan, typical sections, earthwork plans, and other information. A 6-in. PCC surface over a 4-in. crushed aggregate base was proposed for the taxiway (Figure A-36). A portion of Taxiway A was reconstructed in 2012 and the plans for that project included a plan for demolition, safety plans, taxiway plan and profile, typical sections, slab layout plans, grading plan, and other information. The work consisted of a 6-in. PCC surface over a 4-in. recycled aggregate base course (P-207) (Figure A-37).

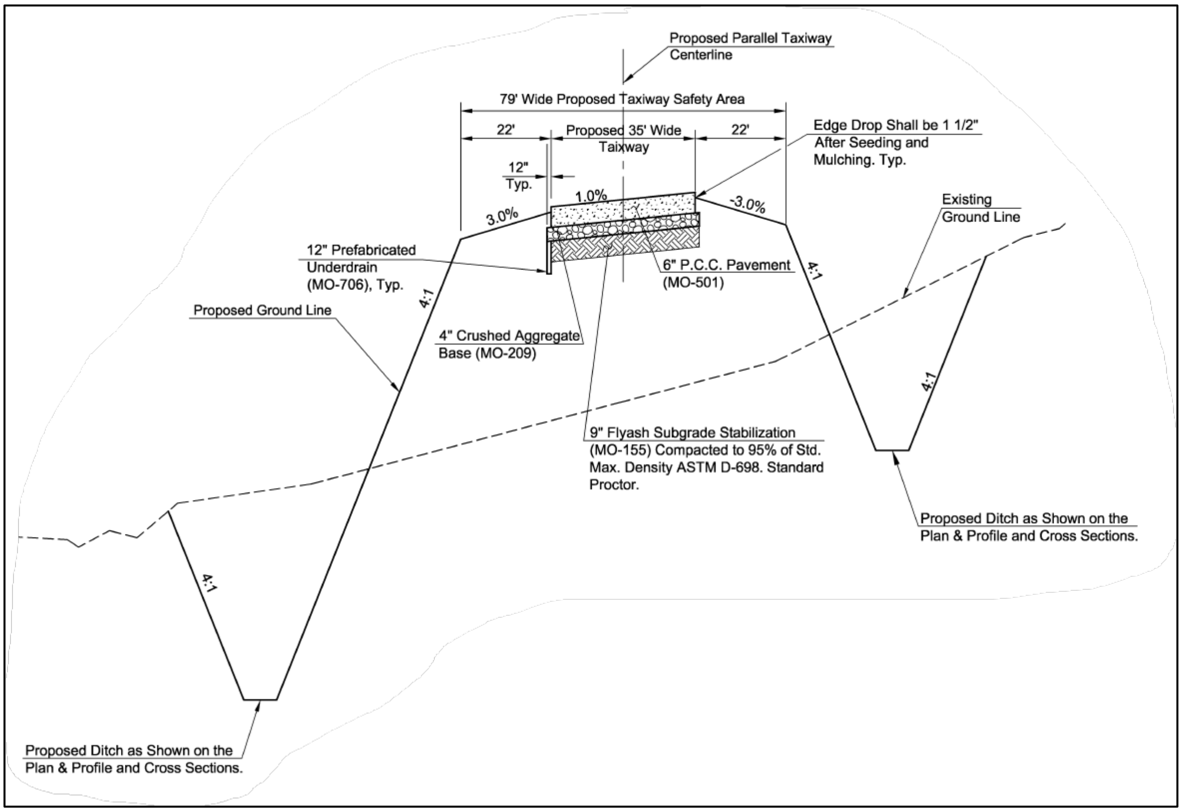

Figure A-36. Taxiway A Typical Section (FAA Specifications) Completed in 2009

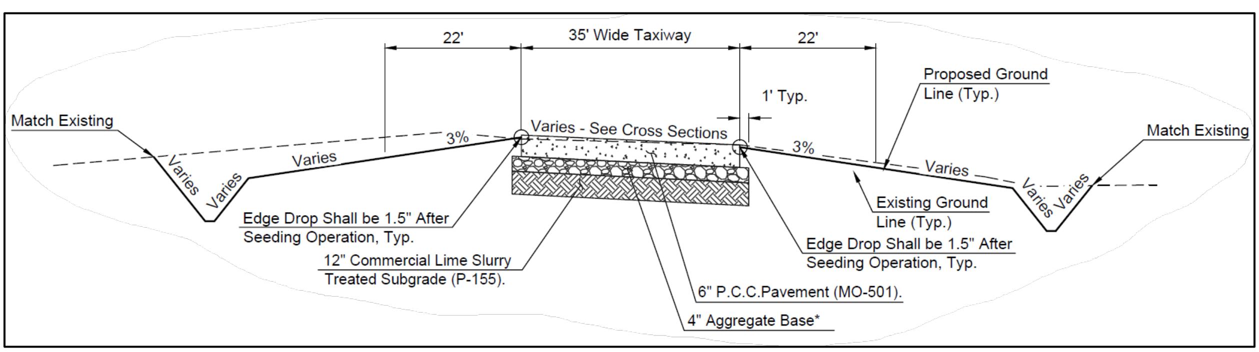

Figure A-37. Taxiway A Typical Section (State Specifications) Completed in 2012

The consultant for this project was BWR, in Kansas City, Missouri (2009 and 2012).

The following state specifications were extracted from the project specifications:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.

- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.

- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.

- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

- MO-706—specifies materials, construction, method of measurement, and basis of payment for prefabricated underdrains.

The following FAA specifications were extracted from the project specifications:

- P-155—specifies materials, composition, weather limitations, equipment, construction methods, method of measurement, and basis of payment for lime-treated subgrade.

- P-207—specifies materials, construction methods, method of measurement, and basis of payment for in-place full depth reclamation (FDR) recycled asphalt aggregate base course.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information regarding the contractor**,** schedule, notations, delays, or other was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2020 Pavement Management Reports, the change in PCI for different sections of Taxiway A is plotted in Figure A-38. For Section 30 constructed in 2009 using FAA

Specifications, the PCI dropped to 88. Section 10 constructed in 2012 using the state Specifications had a PCI of 78. The most prevalent types of distress throughout the taxiway include low- to high-severity joint seal damage along with low- to high-severity linear cracking and low-severity ASR. The taxiway Section 30 exhibited distress deductions primarily associated with climate, with a small percentage of the deductions associated with the *Other* and *Load* categories. On Section 10, most of the distress deductions were associated with *Other* followed by *Climate* and *Load*.

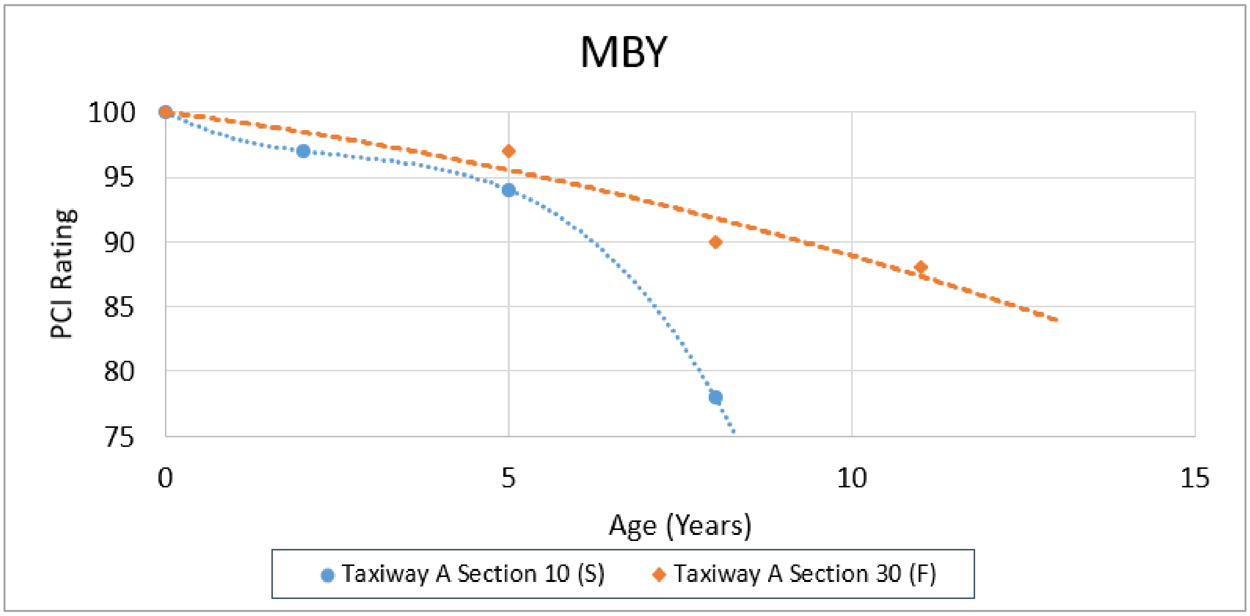

Figure A-38. Taxiway A PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 640
- GA Local: 7,480
- GA Itinerant: 7,300
- Military: 40
- Total Operations: 15,460

Based on the ADIP, Runway 5/23 and 13/31 are rated for the following loads:

- Runway 5/23:
  - Single Wheel—4,000 lb

- Runway 13/31:
  - Single Wheel—30,000 lb
  - Dual Wheel—38,000 lb

A.2.7 Nevada Municipal Airport (NVD)

Owner: City of Nevada
110 S. Ash St.
Nevada, MO 64772
Phone: 417-448-5504
Manager: Jody Bryson
18098 East 54 Highway
Nevada, MO 65772
Phone: 417-448-5107

The Nevada Municipal Airport is a publicly owned GA airport in Nevada, Missouri serving the Vernon County area. This airport covers an area of 219 acres at an elevation of 892 ft. It has two concrete runways: 2/20 (5,000 ft × 75 ft) and 13/31 (2,581 ft × 40 ft), as shown in Figure A-39.

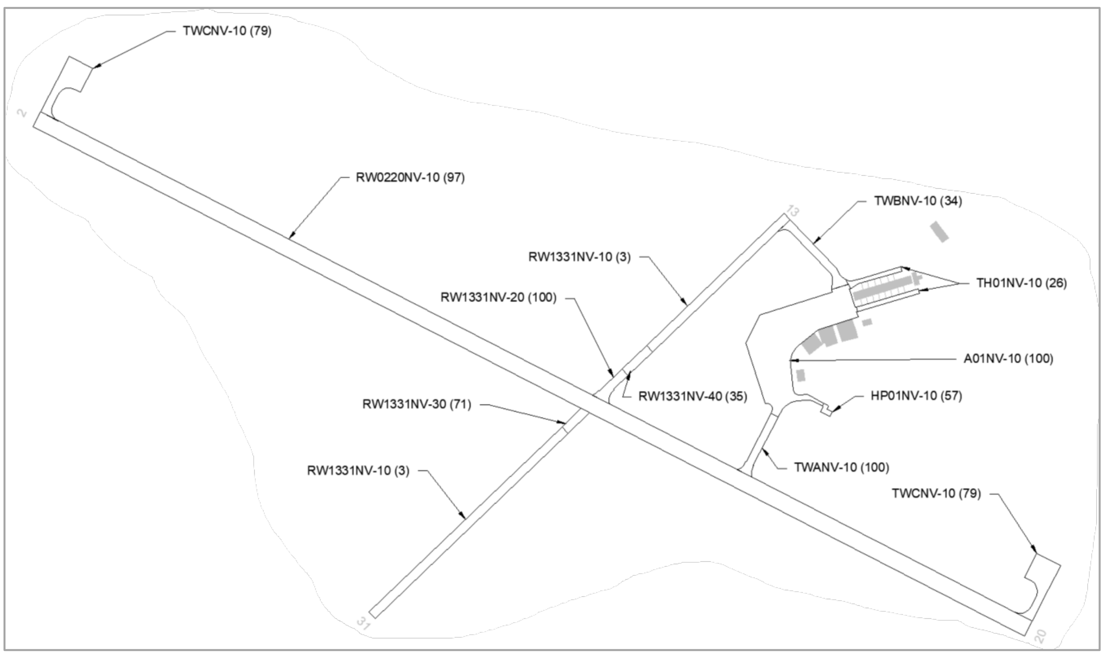

Figure A-39. Nevada Municipal Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Runway 13/31 and Taxiway A

- Reconstruction of Runway 13/31 and Taxiway A (State Specifications) completed in 2012
  - Project Number: 10-082-01

Specifications and Plans

A set of plans was acquired for the reconstruction of a part of Runway 13/31 and Taxiway A, which included a safety plan, demolition plan, runway and taxiway plans with profiles, slab layout plan, typical sections, earthwork plans, and other information. A 6-in. PCC surface over a 4-in. aggregate base was proposed for both the runway (see Figure A-40) and the taxiway.

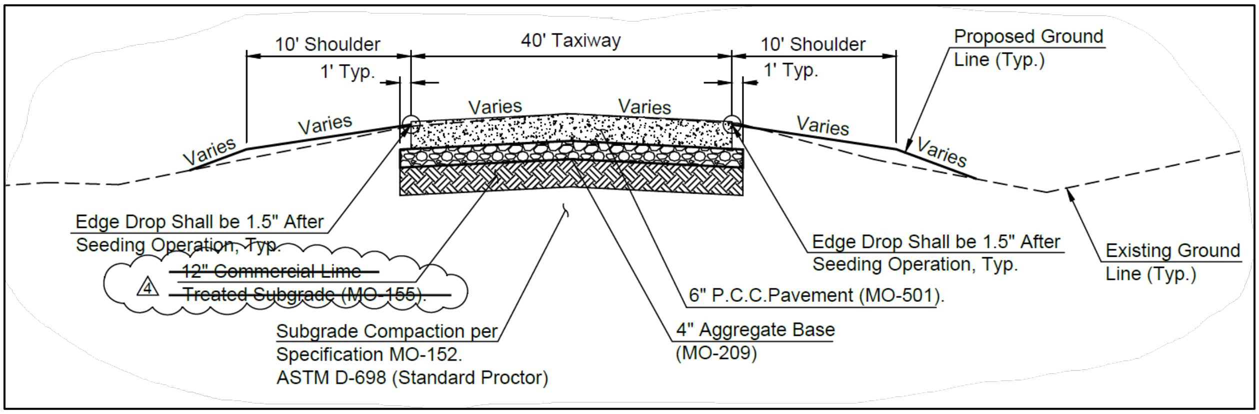

Figure A-40. Runway 13-31 Typical Section

The consultant for this project was Lochner, in Kansas City, Missouri.

The following specifications were extracted from the project plans:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.
- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, construction schedule, notations, delays, or other items was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2019 Pavement Management Reports, the PCIs after 7 years of service were 97 for Runway 13/31 and 96 for Taxiway A. The most prevalent types of distress throughout the taxiway included low- to medium-severity joint seal damage along with high-severity small patching. For the runway, low- and medium-severity joint seal damage were the most prevalent distresses. Because of the minimal deterioration, no performance plot was developed.

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to any preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 10
- GA Local: 4,000
- GA Itinerant: 3,200
- Military: 100
- Total Operations: 7,310

Based on the ADIP, Runway 13/31 is rated for

- Single Wheel—19,000 lb

A.2.8 Lamar Municipal Airport (LLU)

Owner: City of Lamar
132 West 10th St.
Lamar, MO 64759
Phone: 417-682-5554
Manager: Russ Worsley
132 West 10th St.
Lamar, MO 64759
Phone: 417-682-5554

Lamar Municipal Airport is a public airport located 2 miles southwest of the town of Lamar, in Barton County, Missouri. In the NPIAS for 2021–2025, it is categorized as a local GA facility. This airport covers 105 acres at an elevation of 1010 ft. It has two runways: 3/21 (2,900 ft × 60 ft) and 17/35 (4,000 ft × 75 ft) as shown in Figure A-41.

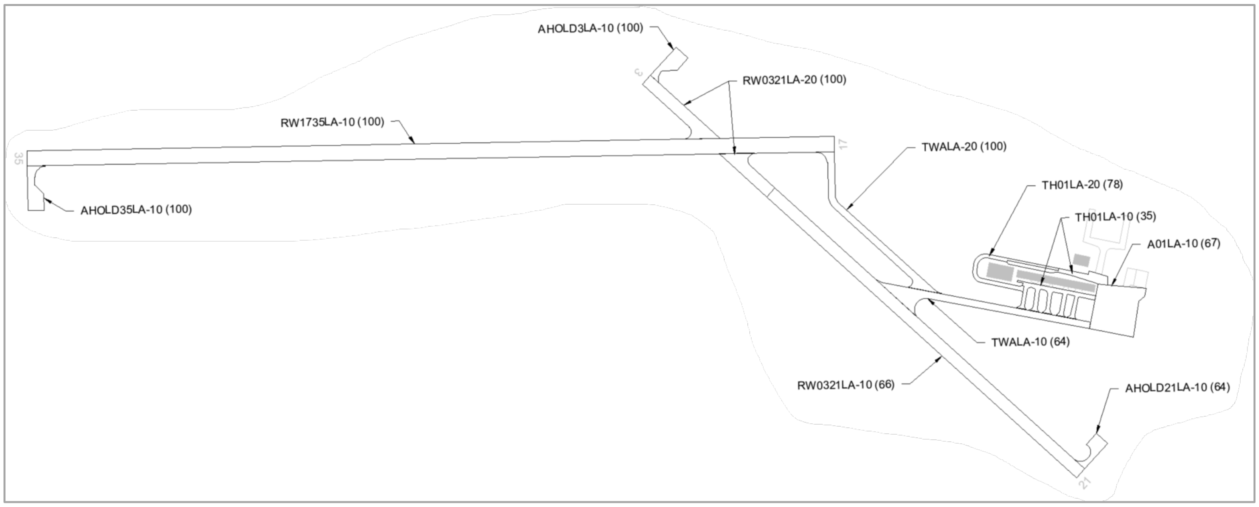

Figure A-41. Lamar Municipal Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Runway 17/35, Runway 3/21, Taxiway A, Hold Apron 3 and 35

- Construction of Runway 17/35, Taxiway A, and Hold Apron 3 and 35 (State Specifications) completed in 2013
- Reconstruction of Runway 3/21 (PCN: 10/R/C/W/T) (State Specifications) completed in 2013
  - Project Number: 09-85A-1

Specifications and Plans

A set of construction plans was acquired for the reconstruction of Runway 3/21 and new construction of Runway 17/35, Taxiway A, and Hold Aprons 03 and 35. This set included associated safety plans, demolition plans, slab layout plans, typical cross sections, grading plans, and other information for all projects. A 6-in. PCC surface over a 4-in. crushed aggregate base was proposed for the runways and taxiway (see Figures A-42 and A-43).

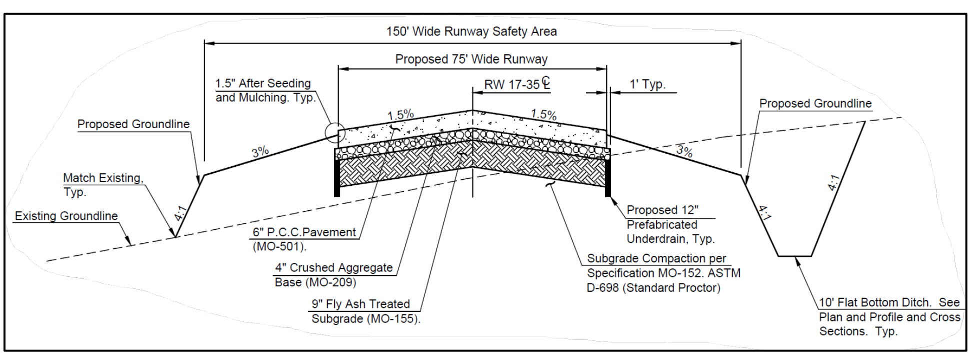

Figure A-42. Runway 17/35 Typical Section

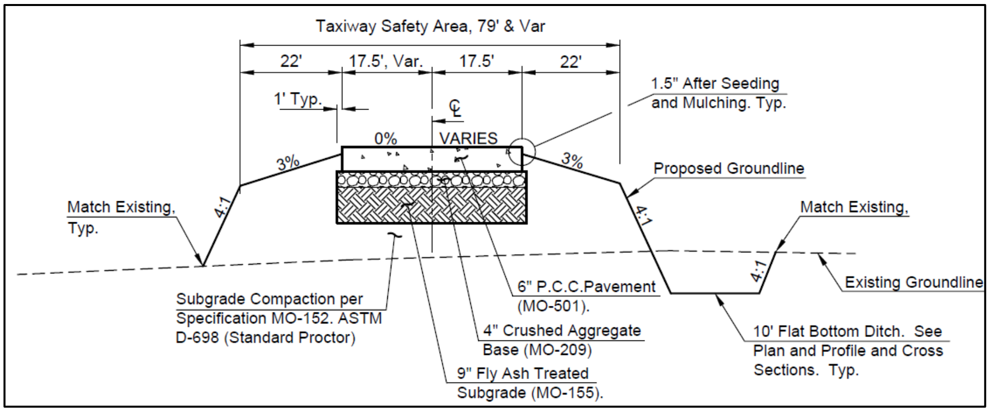

Figure A-43. Taxiway A Typical Section

The consultant for this project was Lochner, in Kansas City, Missouri.

The following state specifications were extracted from the project documentation:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.
- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

Mix Design

No information on mix design submittals and acceptance criteria was provided.

Construction Report

No information about the contractor, schedule, notations, delays, or other items was obtained for this project.

Quality Control and Acceptance Results

No information related to laboratory and field results was obtained for this project.

Pavement Performance Data

Based on the 2019 Pavement Management Reports, Runway 17/35, Runway 03/21, Taxiway A, and Hold Apron 35 all had a PCI of 100. The Hold Apron 03 2019 PCI was 97. The prevalent distress throughout the runway was low-severity joint seal damage. The runway holding apron distresses included low-severity joint seal damage, medium-severity corner breaks, and low-severity corner spalls. Because of the minimal deterioration no plot of performance over time was developed.

History of Preventive or Maintenance Activities Conducted on the Airfield

No information related to preventive or maintenance activities was reported since construction.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 300
- GA Local: 3,200
- GA Itinerant: 1,800
- Military: 20
- Total Operations: 5,320

Based on the ADIP, no load ratings for the runways were available.

A.2.9 Hannibal Regional Airport (HAE)

Owner: City of Hannibal
320 Broadway
Hannibal, MO 63401
Phone: 573-221-0111
Manager: Andy Dorian
City of Hannibal
6079 County Road 425
Hannibal, MO 63401
Phone: 573-406-3728

Hannibal Regional Airport is a public-use airport in Marion County, Missouri. It is located 4 miles northwest of the central business district of Hannibal, Missouri, and is owned by the City of Hannibal. The airport is used for GA with no commercial airlines. This airport covers an area of 400 acres at an elevation of 769 ft. It has a concrete runway designated as 17/35 with a dimension of 4,400 ft by 100 ft, as shown in Figure A-44

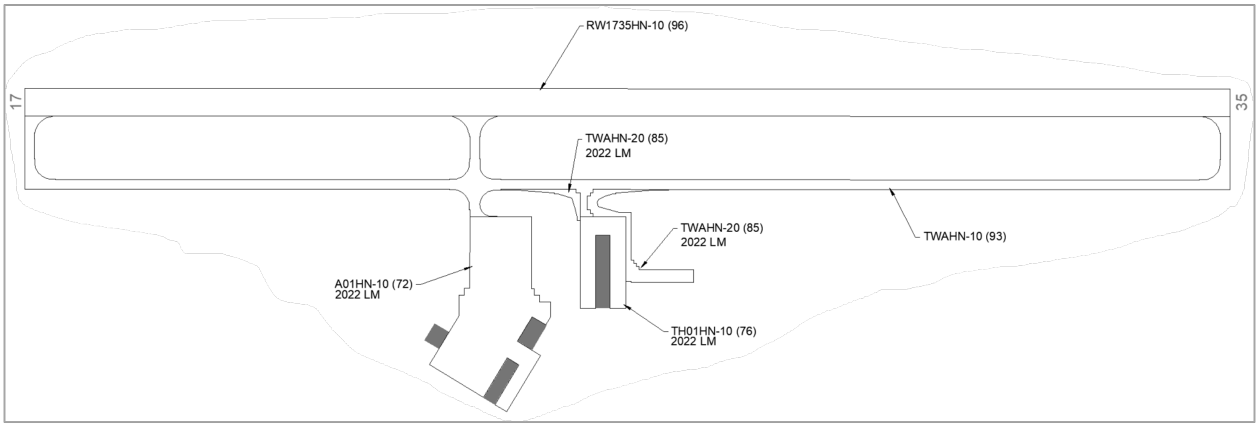

Figure A-44. Hannibal Regional Airport Diagram (source: https://idea.appliedpavement.com/hosting/missouri/)

Runway 17/35

- Reconstruction of Runway 17/35 (PCN: 7/R/B/W/U) (State Specifications) completed in 2002
  - Project Number: AIR 015-49A

Taxiway A

- Construction of Taxiway A (FAA specifications) completed in 2015
  - Project Number: 14-049A-2

Specifications and Plans

Runway 17/35

A set of construction plans was acquired for the reconstruction of Runway of 17/35, which included a demolition plan, slab layout plan, typical cross sections, grading, drainage, plans and other information. A 6-in. PCC over a 4-in. crushed aggregate base was proposed for the runway (Figure A-45).

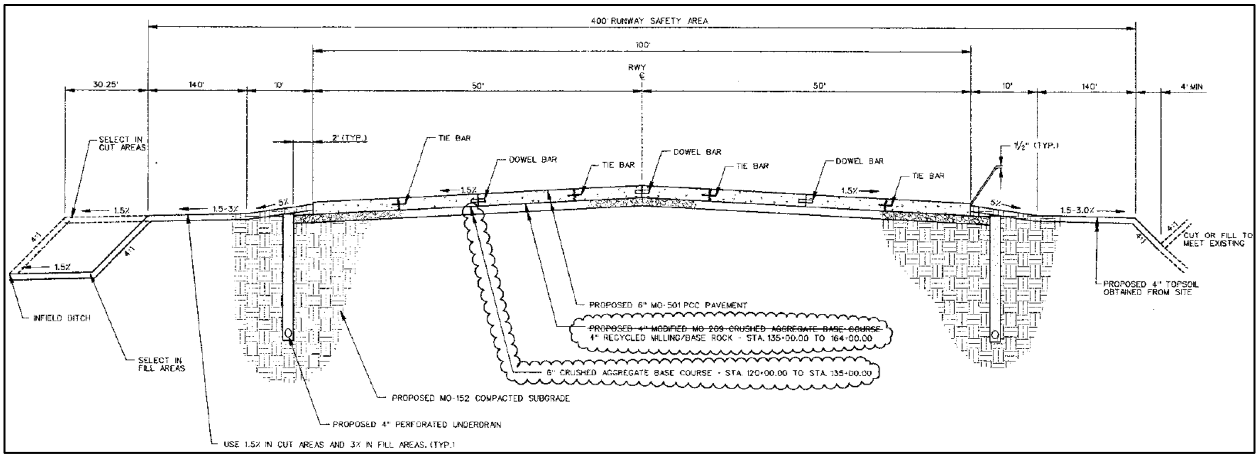

Figure A-45. Runway 17/35 Typical Section

The consultant for this project was Crawford, Murphy & Tilly, Inc., in St. Louis, Missouri.

The following state specifications were extracted from project documentation:

- MO-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.
- MO-209—specifies materials, construction methods, method of measurement, and basis of payment for crushed aggregate base course.
- MO-155—specifies materials, composition, equipment, construction methods, method of measurement, basis of payment, testing requirements, and material requirements for fly ash-treated subgrade.
- MO-152—specifies classification of excavation, construction methods, method of measurement, and basis of payment for excavation and embankment.

<u>Taxiway A</u>

A set of construction plans was acquired for the construction of a part of Taxiway A, which included a demolition plan, slab layout plan, typical cross sections, and other information. A 6-in. PCC surface over a 6-in. crushed aggregate base was proposed for the runway (Figure A-46).

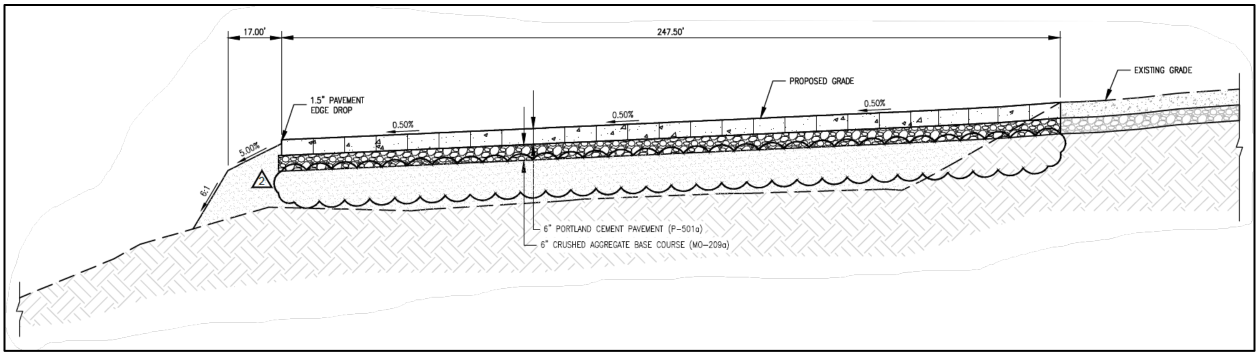

Figure A-46. Taxiway A Typical Section

The consultant for this project was Jviation, in Jefferson City, Missouri.

The following FAA specifications were extracted from project documentation:

- P-501—provides material, material acceptance, mix design, admixtures, construction methods, contractor quality control, method of measurement, and basis of payment for concrete.

<u>Mix Design</u>

No information on mix design submittals and acceptance criteria was provided.

<u>Construction Report</u>

No information of contractor**,** schedule, notations, delays, or other items was obtained for this project.

<u>Quality Control and Acceptance Results</u>

No information related to laboratory and field results was obtained for this project.

<u>Pavement Performance Data</u>

Based on the 2021 Pavement Management Reports, Runway 17/35 had a PCI of 96 (increased from the 2018 PCI of 86 due to a crack sealing project undertaken in 2019). Taxiway A had a PCI of 85. Distresses on the runway included low-severity faulting, joint spalling, and ASR. Pumping, high-severity joint seal damage, and faulting were recorded for the taxiway. A plot showing PCI ratings since the most recent rehabilitation for different parts of the airport is shown in Figure A-47.

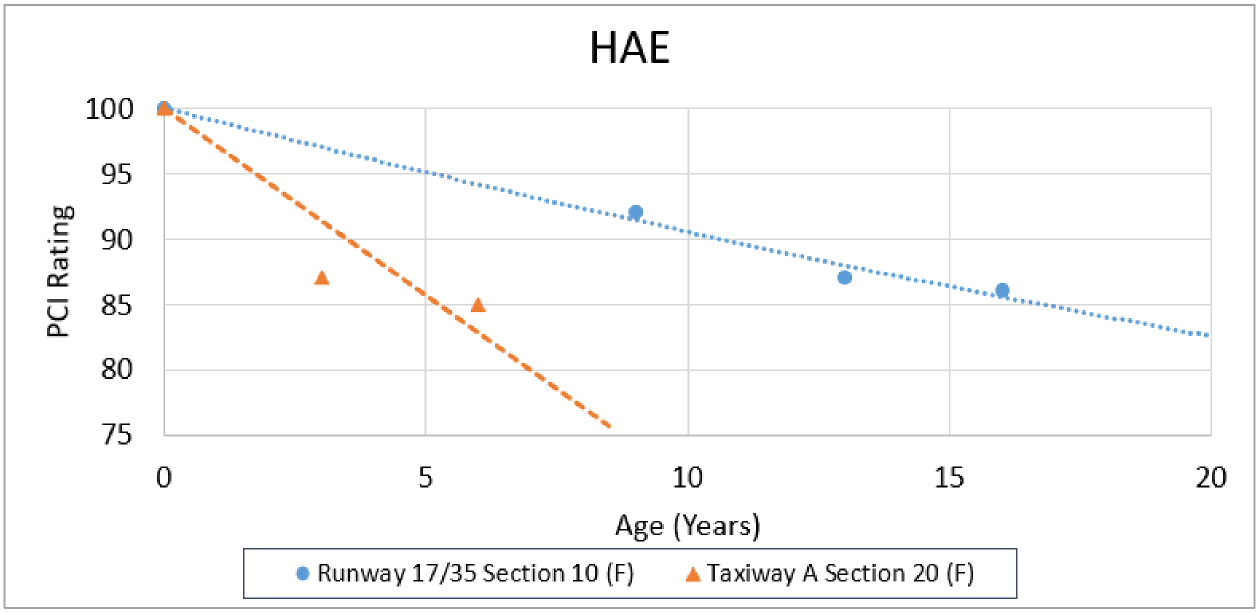

Figure A-47. Hannibal Regional Airport PCI Ratings

History of Preventive or Maintenance Activities Conducted on the Airfield

Joint seal removal, application of new joint sealant, and spall and crack repair work were done on Runway 17/35 and Taxiway A in 2019. The construction plan for the work was prepared by Jviation in Jefferson City, MO.

Aircraft Load and Traffic Data

Based on the ADIP, the overall airport traffic operations per year are as follows:

- Air Carrier: 0
- Air Taxi: 320
- GA Local: 3,458
- GA Itinerant: 5,823
- Military: 60
- Total Operations: 9,661

Based on the ADIP, Runway 17/35 has a load rating of Single Wheel Load—12,000 lb.

APPENDIX B—SUMMARY OF DISTRESSES AND DISTRESS DEDUCTIONS

B.1 INTRODUCTION

The individual airport distresses and distress deducts for each of the airports included in this study are presented in this appendix. These data are taken from the most recent pavement condition index (PCI) inspection data available in the state Airport Pavement Management System (APMS) database. During a PCI inspection, the pavement is divided into branches that are then further subdivided into sections, and each section is then divided into sample units. The type and severity of each type of pavement distress is assessed by visual inspection of the pavement sample units, following the identification and quantification processes described in Appendix X1 and Appendix X2 of ASTM D5340 (ASTM, 2018). The distress data are then used to calculate the PCI for each sample unit. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

A brief description of each item in the summaries is as follows:

- Distress: Code used in the PCI procedure (ASTM, 2018) to categorize the airfield concrete pavement distress into one of sixteen distress types
- Description: A brief description of the type of distress being reported
- Severity: Description of how severe the distress is, usually identified as low, medium, and high
- Quantity: Total amount of distress measured in that section
- Units: Unit of measure for the type of distress
- Density: Intensity of the distresses based on the quantity of distresses divided by the total section size
- Deduct: Deduct values based on charts in Appendix X3 of ASTM D5340 (ASTM, 2018)

The deducts are then characterized into one of three categories: load-related, climate-related, and other, and the deducts in each category as a percentage of the total deducts is determined.

B.2 IOWA

Tables B-1 through B-14 list the distresses for all Iowa airports examined in this study.

Table B-1. Boone Municipal Airport—Runway 15/33 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	Low	16.67	Slabs	0.9	1.1
65	JT SEAL DMG	Medium	1,801	Slabs	100.0	7.0
71	FAULTING	Low	33.35	Slabs	1.9	1.8
75	CORNER SPALL	Medium	8.34	Slabs	0.5	0.9

Percent of distress deduct: load 10; climate 65; other 25.

Table B-2. Mount Pleasant Municipal Airport—Apron 02 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	Low	3.44	Slabs	0.6	0.8
62	CORNER BREAK	Medium	3.44	Slabs	0.6	1.9
63	LINEAR CR	Low	24.06	Slabs	4.4	4.3
63	LINEAR CR	Medium	10.31	Slabs	1.9	4.6
65	JT SEAL DMG	High	343.75	Slabs	62.5	12.0
65	JT SEAL DMG	Medium	205.25	Slabs	37.5	7.0
66	SMALL PATCH	Low	6.88	Slabs	1.3	0.3
72	SHAT. SLAB	Low	3.44	Slabs	0.6	2.3
72	SHAT. SLAB	Medium	3.44	Slabs	0.6	5.7
74	JOINT SPALL	Medium	6.88	Slabs	1.3	1.0

Percent of distress deduct: load 49; climate 48; other 3

Table B-3. Mount Pleasant Municipal Airport—Apron 02 Section 02—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	High	143	Slabs	100.0	12.0
74	JOINT SPALL	Medium	1.49	Slabs	1.0	0.8
75	CORNER SPALL	Low	2.98	Slabs	2.1	0.9
75	CORNER SPALL	Medium	4.47	Slabs	3.1	2.6
76	ASR	Low	8.94	Slabs	6.3	6.0
76	ASR	Medium	1.49	Slabs	1.0	3.5

Percent of distress deduct: load 0; climate 47; other 53

Table B-4. Mount Pleasant Municipal Airport—Apron 02 Section 03—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	Medium	110	Slabs	100.0	7.0
71	FAULTING	Low	3.06	Slabs	2.8	2.7
74	JOINT SPALL	Medium	1.53	Slabs	1.4	1.1
76	ASR	Low	3.06	Slabs	2.8	3.1

Percent of distress deduct: load 0; climate 51; other 49

Table B-5. Ames Municipal Airport—Runway 13/31 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	Low	1,728	Slabs	100.0	2.0

Percent of distress deduct: load 0; climate 100; other 0

Table B-6. Ames Municipal Airport—Runway 13/31 Section 04—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	Low	460	Slabs	62.5	2.0
65	JT SEAL DMG	Medium	276.38	Slabs	37.5	7.0
71	FAULTING	Low	13.82	Slabs	1.9	1.8

Percent of distress deduct: load 0; climate 83; other 17

Table B-7. Fort Dodge Regional Airport—Taxiway C Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	Low	2.45	Slabs	0.8	0.8
65	JT SEAL DMG	Medium	309	Slabs	100.0	7.0
71	FAULTING	Low	7.36	Slabs	2.4	2.3
74	JOINT SPALL	Low	2.45	Slabs	0.8	0.3

Percent of distress deduct: load 8; climate 67; other 25

Table B-8. Webster City Municipal Airport—Runway 05/23 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	Low	12.78	Slabs	5.8	5.5
65	JT SEAL DMG	Medium	219	Slabs	100.0	7.0
74	JOINT SPALL	Low	1.83	Slabs	0.8	0.3

Percent of distress deduct: load 43; climate 54; other 3

Table B-9. Webster City Municipal Airport—Runway 14/32 Section 01—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	Low	14.84	Slabs	0.9	1.1
65	JT SEAL DMG	Medium	1,603	Slabs	100.0	7.0
71	FAULTING	Low	66.79	Slabs	4.2	3.9
74	JOINT SPALL	Low	22.26	Slabs	1.4	0.5

Percent of distress deduct: load 9; climate 56; other 35

Table B-10. Webster City Municipal Airport—Taxiway 01 Section 02—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	Low	2.49	Slabs	0.7	1.0
65	JT SEAL DMG	Medium	348	Slabs	100.0	7.0
74	JOINT SPALL	Low	2.49	Slabs	0.7	0.3
74	JOINT SPALL	Medium	2.49	Slabs	0.7	0.8

Percent of distress deduct: load 12; climate 76; other 12

Table B-11. Webster City Municipal Airport—Taxiway 03 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	Medium	323	Slabs	100.0	7.0
71	FAULTING	Low	2.52	Slabs	0.8	1.0
74	JOINT SPALL	Low	2.52	Slabs	0.8	0.3
74	JOINT SPALL	Medium	2.52	Slabs	0.8	0.8
75	CORNER SPALL	Low	5.05	Slabs	1.6	0.7

Percent of distress deduct: load 0; climate 71; other 29

Table B-12. Webster City Municipal Airport—Taxiway 04 Section 01—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	Medium	236	Slabs	100.0	7.0
71	FAULTING	Low	3.81	Slabs	1.6	1.6
74	JOINT SPALL	Low	1.9	Slabs	0.8	0.3
74	JOINT SPALL	Medium	1.9	Slabs	0.8	0.8

Percent of distress deduct: load 0; climate 72; other 28

Table B-13. Jefferson Municipal Airport—Runway 14/32 Section 01—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	Low	63.19	Slabs	4.7	4.5
63	LINEAR CR	Medium	70.12	Slabs	5.2	11.3
65	JT SEAL DMG	High	1,011	Slabs	75.0	12.0
65	JT SEAL DMG	Medium	337	Slabs	25.0	7.0
71	FAULTING	Low	56.17	Slabs	4.2	3.9
71	FAULTING	Medium	7.02	Slabs	0.5	1.8
73	SHRINKAGE CR	N/A	7.02	Slabs	0.5	0.3

Percent of distress deduct: load 39; climate 46; other 15

Table B-14. Jefferson Municipal Airport—Runway 14/32 Section 02—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	Low	1.14	Slabs	1.1	0.9
63	LINEAR CR	Low	4.57	Slabs	4.4	4.3
63	LINEAR CR	Medium	1.14	Slabs	1.1	2.8
65	JT SEAL DMG	High	48	Slabs	46.2	12.0
65	JT SEAL DMG	Low	28.57	Slabs	27.5	2.0
65	JT SEAL DMG	Medium	27.43	Slabs	26.4	7.0
71	FAULTING	Low	2.29	Slabs	2.2	2.1
72	SHAT. SLAB	Low	1.14	Slabs	1.1	2.5
74	JOINT SPALL	Low	3.43	Slabs	3.3	1.1
74	JOINT SPALL	Medium	1.14	Slabs	1.1	0.9
75	CORNER SPALL	Medium	1.14	Slabs	1.1	1.0

Percent of distress deduct: load 29; climate 57; other 14

B.3 MISSOURI

Tables B-15 through B-51 list the distresses for all Missouri airports examined in this study.

Table B-15. Eldon Model Airpark—Runway 18/36 Section 10—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	1413.21	Slabs	83.7	12
65	JT SEAL DMG	M	274.79	Slabs	16.3	7
66	SMALL PATCH	L	13.09	Slabs	0.8	0.2
71	FAULTING	L	19.63	Slabs	1.2	1.1
73	SHRINKAGE CR	N/A	32.71	Slabs	1.9	0.5
74	JOINT SPALL	L	13.09	Slabs	0.8	0.3
75	CORNER SPALL	L	6.54	Slabs	0.4	0.4

Percent of distress deduct: load 0; climate 88; other12

Table B-16. Eldon Model Airpark—Runway 18/36 Section 20—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	M	600	Slabs	100	7
71	FAULTING	L	6.06	Slabs	1	1

Percent of distress deduct: load 0; climate 87; other 13

Table B-17. Eldon Model Airpark—Taxiway A Section 10—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	317.25	Slabs	75	2
65	JT SEAL DMG	M	105.75	Slabs	25	7
71	FAULTING	L	6.61	Slabs	1.6	1.5
71	FAULTING	M	4.41	Slabs	1	1.8
73	SHRINKAGE CR	N/A	2.2	Slabs	0.5	0.3
74	JOINT SPALL	L	4.41	Slabs	1	0.4
74	JOINT SPALL	M	4.41	Slabs	1	0.8
75	CORNER SPALL	M	4.41	Slabs	1	0.9

Percent of distress deduct: load 0; climate 61; other 39

Table B-18. Eldon Model Airpark—Taxiway A Section 20—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	163.55	Slabs	8.2	2
65	JT SEAL DMG	M	1834.55	Slabs	91.8	7
66	SMALL PATCH	L	8.18	Slabs	0.4	0.2
74	JOINT SPALL	M	1	Slabs	0.1	0.8

Percent of distress deduct: load 0; climate 90; other 10

Table B-19. Eldon Model Airpark—Taxiway A Section 30—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	40	Slabs	100	12
74	JOINT SPALL	M	1	Slabs	2.5	2

Percent of distress deduct: load 0; climate 86; other 14

Table B-20. Lamar Municipal Airport—Taxiway A-20—State Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-21. Lamar Municipal Airport—Hold Apron from Runway 35 Section 10—State Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-22. Lamar Municipal Airport—Hold Apron from Runway 3 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	20.2	Slabs	17	2
62	CORNER BREAK	M	1	Slabs	0.8	1.9
66	SMALL PATCH	L	1	Slabs	0.8	0.2
74	JOINT SPALL	L	1	Slabs	0.8	0.3
75	CORNER SPALL	L	1	Slabs	0.8	0.4

Percent of distress deduct: load 38; climate 41; other 21

Table B-23. Lamar Municipal Airport—Runway 3/21 Section 20—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	50.67	Slabs	11.1	2
66	SMALL PATCH	L	2.11	Slabs	0.5	0.2

Percent of distress deduct: load 0; climate 89; other 11

Table B-24. Lamar Municipal Airport—Runway 17/35 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	738.46	Slabs	23.1	2

Percent of distress deduct: load 0; climate 100; other 0

Table B-25. Lee's Summit Municipal Airport—East Apron Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	602.93	Slabs	41.1	2
65	JT SEAL DMG	M	131.07	Slabs	8.9	7

Percent of distress deduct: load 0; climate 100; other 0

Table B-26. Lee's Summit Municipal Airport—Runway 11/29 Section 20—FAA Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-27. Lee's Summit Municipal Airport—Runway 11/29 Section 30—FAA Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-28. Lee's Summit Municipal Airport—Runway 18/36 Section 10—State Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-29. Lee's Summit Municipal Airport—Taxiway C Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	L	7.86	Slabs	0.8	0.8
65	JT SEAL DMG	H	519.05	Slabs	55.9	12
65	JT SEAL DMG	M	408.95	Slabs	44.1	7
67	LARGE PATCH	L	3.93	Slabs	0.4	0.7
74	JOINT SPALL	M	3.93	Slabs	0.4	0.8

Percent of distress deduct: load 4; climate 89; other 7

Table B-30. Lee's Summit Municipal Airport—Taxiway C Section 20—FAA Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-31. Macon-Fower Memorial Airport—Runway 2/20 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	L	4	Slabs	0.1	1.1
65	JT SEAL DMG	L	2558.46	Slabs	77.1	2
65	JT SEAL DMG	M	761.54	Slabs	22.9	7
71	FAULTING	L	63.46	Slabs	1.9	1.9

Percent of distress deduct: load 9; climate 75; other 16

Table B-32. Macon-Fower Memorial Airport—Taxiway A Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	144	Slabs	100	2

Percent of distress deduct: load 0; climate 100; other 0

Table B-33. Macon-Fower Memorial Airport—Taxiway A Section 20—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	537	Slabs	100	2
71	FAULTING	L	2.74	Slabs	0.5	1

Percent of distress deduct: load 0; climate 67; other 33

Table B-34. Nevada Municipal Airport—Taxiway A Section 10—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	148	Slabs	100	2
66	SMALL PATCH	H	1	Slabs	0.7	1.5

Percent of distress deduct: load 0; climate 57; other 43

Table B-35. Nevada Municipal Airport—Runway 13/31 Section 20—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	41.14	Slabs	64.3	2
65	JT SEAL DMG	M	22.86	Slabs	35.7	7

Percent of distress deduct: load 0; climate 100; other 0

Table B-36. Sedalia Regional Airport—Runway 18/36 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	2652	Slabs	100	2

Percent of distress deduct: load 0; climate 100; other 0

Table B-37. Sedalia Regional Airport—Runway 18/36 Section 20—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	L	11.11	Slabs	2.8	2.8
63	LINEAR CR	M	8.89	Slabs	2.2	5.4
65	JT SEAL DMG	H	400	Slabs	100	12
73	SHRINKAGE CR	N/A	17.78	Slabs	4.4	1
74	JOINT SPALL	L	2.22	Slabs	0.6	0.3

Percent of distress deduct: load 38; climate 56; other 6

Table B-38. Sedalia Regional Airport—Taxiway A Section 10—State Specs (no distress)

Distress	Description	Severity	Quantity	Units	Density	Deduct
-	-	-	-	-	-	-

Percent of distress deduct: load 0; climate 0; other 0

Table B-39. Sedalia Regional Airport—Taxiway A Section 20—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	28.78	Slabs	16.3	2
65	JT SEAL DMG	M	30.22	Slabs	17.1	7
66	SMALL PATCH	L	4.32	Slabs	2.4	0.6
67	LARGE PATCH	L	1.44	Slabs	0.8	0.7
74	JOINT SPALL	L	1.44	Slabs	0.8	0.3
75	CORNER SPALL	H	1.44	Slabs	0.8	1
76	ASR	L	4.32	Slabs	2.4	2.7

Percent of distress deduct: load 0; climate 63; other 37

Table B-40. Omar N. Bradley Airport—Taxiway A Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	L	1.33	Slabs	1.1	0.9
63	LINEAR CR	L	2.67	Slabs	2.2	2.2
63	LINEAR CR	M	1.33	Slabs	1.1	2.7
65	JT SEAL DMG	L	108	Slabs	87.1	2
65	JT SEAL DMG	M	16	Slabs	12.9	7
71	FAULTING	L	2.67	Slabs	2.2	2.1
71	FAULTING	M	1.33	Slabs	1.1	1.9
74	JOINT SPALL	M	1.33	Slabs	1.1	0.9
76	ASR	L	26.67	Slabs	21.5	12.2

Percent of distress deduct: load 18; climate 28; other 54

Table B-41. Omar N. Bradley Airport—Taxiway A Section 30—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	H	1	Slabs	0.1	3
62	CORNER BREAK	M	1	Slabs	0.1	1.9
63	LINEAR CR	L	10.54	Slabs	0.6	1.1
65	JT SEAL DMG	H	853.64	Slabs	45	12
65	JT SEAL DMG	L	170.73	Slabs	9	2
65	JT SEAL DMG	M	873.64	Slabs	46	7
71	FAULTING	L	17.07	Slabs	0.9	1
71	FAULTING	H	1	Slabs	0.1	3.6
71	FAULTING	M	2	Slabs	0.1	1.8
73	SHRINKAGE CR	N/A	27.61	Slabs	1.5	0.4
74	JOINT SPALL	L	1	Slabs	0.1	0.3
75	CORNER SPALL	M	1	Slabs	0.1	0.9
76	ASR	L	36.15	Slabs	1.9	2.2

Percent of distress deduct: load 16; climate 57; other 27

Table B-42. Branson West Municipal-Emerson Field—Apron 1 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	88.13	Slabs	46.9	2
65	JT SEAL DMG	M	99.88	Slabs	53.1	7

Percent of distress deduct: load 0; climate 100; other 0

Table B-43. Branson West Municipal-Emerson Field—Apron 2 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	L	4.73	Slabs	1.1	1.2
65	JT SEAL DMG	L	142	Slabs	33.3	2
65	JT SEAL DMG	M	284	Slabs	66.7	7
73	SHRINKAGE CR	N/A	2.37	Slabs	0.6	0.3

Percent of distress deduct: load 11; climate 87; other 2

Table B-44. Branson West Municipal-Emerson Field—Apron 3 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	L	250.49	Slabs	56.5	2
65	JT SEAL DMG	M	55.66	Slabs	12.6	7
71	FAULTING	L	23.19	Slabs	5.2	4.8
73	SHRINKAGE CR	N/A	2.32	Slabs	0.5	0.3

Percent of distress deduct: load 0; climate 64; other 36

Table B-45. Branson West Municipal-Emerson Field—Apron 4 Section 10—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	114.39	Slabs	43.7	12
65	JT SEAL DMG	L	73.8	Slabs	28.2	2
65	JT SEAL DMG	M	73.8	Slabs	28.2	7

Percent of distress deduct: load 0; climate 100; other 0

Table B-46. Branson West Municipal-Emerson Field—Runway 03/21 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	203.92	Slabs	8.3	12
65	JT SEAL DMG	L	203.92	Slabs	8.3	2
65	JT SEAL DMG	M	2039.17	Slabs	83.3	7
66	SMALL PATCH	L	25.49	Slabs	1	0.3
74	JOINT SPALL	L	8.5	Slabs	0.3	0.3
75	CORNER SPALL	L	8.5	Slabs	0.3	0.4

Percent of distress deduct: load 0; climate 95; other 5

Table B-47. Branson West Municipal-Emerson Field—T-Hangar 1 Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	L	2.28	Slabs	0.4	0.8
65	JT SEAL DMG	L	524	Slabs	100	2

Percent of distress deduct: load 28; climate 72; other 0

Table B-48. Branson West Municipal-Emerson Field—Taxiway A Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	236.33	Slabs	16.7	12
65	JT SEAL DMG	L	236.33	Slabs	16.7	2
65	JT SEAL DMG	M	945.33	Slabs	66.7	7
71	FAULTING	L	5.63	Slabs	0.4	1

Percent of distress deduct: load 0; climate 95; other 5

Table B-49. Branson West Municipal-Emerson Field—Taxiway D Section 10—State Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
62	CORNER BREAK	L	2.4	Slabs	0.5	0.8
63	LINEAR CR	L	7.21	Slabs	1.6	1.7
65	JT SEAL DMG	M	440	Slabs	100	7
66	SMALL PATCH	H	2.4	Slabs	0.5	1.5
66	SMALL PATCH	L	4.81	Slabs	1.1	0.3
66	SMALL PATCH	M	2.4	Slabs	0.5	0.7
73	SHRINKAGE CR	N/A	2.4	Slabs	0.5	0.3

Distress	Description	Severity	Quantity	Units	Density	Deduct
74	JOINT SPALL	L	12.02	Slabs	2.7	0.9
74	JOINT SPALL	M	4.81	Slabs	1.1	0.9
75	CORNER SPALL	M	2.4	Slabs	0.5	0.9

Percent of distress deduct: load 17; climate 47; other 36

Table B-50. Hannibal Regional Airport—Runway 17/35 Section 10—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
63	LINEAR CR	L	10.83	Slabs	0.4	1.1
66	SMALL PATCH	L	54.15	Slabs	1.9	0.4
67	LARGE PATCH	L	10.83	Slabs	0.4	0.7
71	FAULTING	L	54.15	Slabs	1.9	1.9
73	SHRINKAGE CR	N/A	21.66	Slabs	0.8	0.3
74	JOINT SPALL	L	43.32	Slabs	1.5	0.5
76	ASR	L	32.49	Slabs	1.2	1.4

Percent of distress deduct: load 17; climate 0; other 83

Table B-51. Hannibal Regional Airport—Taxiway A Section 20—FAA Specs

Distress	Description	Severity	Quantity	Units	Density	Deduct
65	JT SEAL DMG	H	257	Slabs	100	12
69	PUMPING	N/A	7.21	Slabs	2.8	2.9
71	FAULTING	H	1	Slabs	0.4	3.6

Percent of distress deduct: load 0; climate 65; other 35

B.4 REFERENCES

ASTM International (ASTM). (2018). *Standard test method for airport pavement condition index surveys* (ASTM D5340-12). West Conshohocken, PA.