

Audubon County Airport

Pavement Classification Number Report



TECHNICAL EVALUATION

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AUDUBON COUNTY AIRPORT PAVEMENT CLASSIFICATION NUMBER REPORT TECHNICAL EVALUATION

PREPARED FOR:

**IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF AVIATION**

PREPARED BY:

APPLIED PAVEMENT TECHNOLOGY, INC.

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INTRODUCTION

As part of the airport pavement management system (APMS) update for the Iowa Department of Transportation, Office of Aviation (Iowa DOT), Applied Pavement Technology, Inc. (APTech) determined Pavement Classification Numbers (PCNs) for runway pavements at Audubon County Airport and other airports included in the 2017 phase of the APMS update. The PCNs established as part of this project will help decision-makers from the Iowa DOT, the Federal Aviation Administration (FAA), and Audubon County Airport determine what aircraft should (or should not) be able to safely use the airport without causing damage to the valuable runway infrastructure; taxiway and apron pavements were not evaluated as part of this project and might have varying structural capacities.

Critical inputs for determining PCNs using a technical approach include pavement cross section, subgrade strength, and aircraft traffic. The Iowa DOT, through collaboration with the FAA, provided design records containing pavement cross section and subgrade data. Where recent design information was available, traffic data associated with the pavement design were also provided. In cases where this information was not directly available, through a review of publicly -available data and input from Airport Managers, APTech compiled a representative traffic mix for use in the PCN analysis.

APTech used the collected information to determine the PCNs for each included pavement section in accordance with the FAA Advisory Circular 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength – PCN*, and supporting COMFAA 3.0 software. Note that PCNs are only intended as a method to report pavement strength for pavements designed for airplane loads of 12,500 pounds or greater. The pavement sections are consistent with those identified as part of the APMS update and used for Pavement Condition Index (PCI) inspections, where sections are defined by attributes such as cross section, construction history, traffic use, and overall performance. The map included in Appendix A identifies the included pavement sections at Audubon County Airport.

This report includes a general overview of the Aircraft Classification Number – Pavement Classification Number (ACN–PCN) system; relevant information regarding the PCI results, especially regarding load-related distress; required inputs for determining PCNs; and the resulting PCNs.

PAVEMENT CONDITION SUMMARY

As part of the Iowa DOT's statewide APMS project, APTech visually assessed the pavement using the PCI procedure. This procedure is described in FAA Advisory Circular 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*, FAA Advisory Circular 150/5380-7B, *Airport Pavement Management Program (PMP)*, and ASTM D5340-12, *Standard Test Method for Airport Pavement Condition Index Surveys*, and is supported by the PAVER pavement management software. Detailed information regarding the PCI procedure and results can be found in the Pavement Management Report for this airport.

Pavement condition data are not directly used in the structural analysis; however, the results should be considered when determining the PCN to publish. For example, a pavement exhibiting a significant amount of load-related distress provides a strong indication that the past traffic has exceeded the limits the structure can support. The following distresses are considered load-related in the calculation:

- Hot-mix asphalt (HMA)-surfaced pavement:
 - Alligator (fatigue) cracking.
 - Rutting.
- Portland cement concrete (PCC) pavement:
 - Corner break.
 - Longitudinal, transverse, and diagonal (LTD) cracking.
 - Shattered slab.

For reference, the percent of the PCI deduct caused by load-related distress and the specific load-related distress(es) recorded during the most recent pavement inspection at Audubon County Airport are summarized in Table 1.

Table 1. PCI results.

| Branch ¹ | Section ¹ | Surface Type ² | Last Construction Date | 2017 PCI | Deduct due to Load-Related Distress, % | Load-Related Distress Observed ³ |
|---------------------|----------------------|---------------------------|------------------------|----------|--|---|
| R14AU | 01 | PCC | 6/3/2012 | 98 | 0 | None |
| R14AU | 02 | PCC | 6/1/1990 | 85 | 27 | Corner Break, LTD Cracking |

¹See Figure A-1 located in Appendix A for the location of the branch and section.

²AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.

³Distress types are defined by ASTM D5340-12.

Runway 14-32 Section 01 represents the original portion of the runway, which was reconstructed in 2012. Section 02 is a runway extension constructed in 1990; however, no work was done on this portion of the runway in 2012. As such, Section 02 has a lower PCI with load-related distress.

ACN–PCN OVERVIEW

The ACN–PCN system of reporting pavement strength was developed by the International Civil Aviation Organization (ICAO). Since the United States is a member of this organization, the FAA is obligated to adhere to this system and provides guidance to comply with the ICAO standards.

The ACN–PCN procedure is structured so that a pavement with a given PCN can support an aircraft that has an ACN equal to or less than the PCN. Likewise, the pavement cannot, according to the procedure, handle frequent loadings from an aircraft with an ACN exceeding the PCN. Some infrequent overloads are allowed in accordance with the general overload guidance, which is presented within this report. Aircraft operators are required to obtain permission to use a facility when their aircraft's ACN exceeds the published PCN.

ACNs

According to the FAA Advisory Circular 150/5335-5C, the ACN is defined as a number that expresses the relative effect of an aircraft at a given weight on a pavement structure for a specified standard subgrade strength. The ACN can be calculated for any operating weight. Higher ACNs indicate an aircraft has a more severe effect on the pavement, while lower values indicate a less severe effect.

ACNs are reported by pavement type (i.e., rigid or flexible) and subgrade strength category (i.e., A, B, C, or D, as defined later). Pavements with a PCC layer are generally considered rigid, including those with an HMA overlay; HMA pavements (without underlying PCC layers) are considered flexible. Stronger subgrade support conditions (e.g., granular subgrade soils with higher k-values or California Bearing Ratios [CBRs]) correspond to lower ACNs as compared to weaker subgrade support conditions. The ACN has a minimum value of 0 and no upper limit.

A list of ACNs for common aircraft is shown in Table 2 to assist decision-makers with determining whether the analyzed pavements can realistically support aircraft that might not be in the traffic mix. The listed ACNs were determined using COMFAA, the FAA's software, and are presented for each subgrade strength category for both flexible and rigid pavement types; the presented ACNs are for the specified aircraft weight and tire pressure. For a given aircraft, the ACNs will decrease as aircraft weight decreases. It is also worth noting that tire pressure influences the ACNs determined for specific aircraft. For example, given two aircraft with similar weights and gear configurations (for a specific pavement type and subgrade strength category), the aircraft with the lower tire pressure will have a lower ACN, indicating that its demand on a pavement is less than a similar aircraft with a higher tire pressure.

Table 2. ACNs for common aircraft by pavement type and subgrade category (not specific to this airport).

| Aircraft | Weight, lbs | Tire Pressure, psi | Gear Type ¹ | ACN: Flexible Pavement, Subgrade Category A | ACN: Flexible Pavement, Subgrade Category B | ACN: Flexible Pavement, Subgrade Category C | ACN: Flexible Pavement, Subgrade Category D | ACN: Rigid Pavement, Subgrade Category A | ACN: Rigid Pavement, Subgrade Category B | ACN: Rigid Pavement, Subgrade Category C | ACN: Rigid Pavement, Subgrade Category D |
|--------------------|-------------|--------------------|------------------------|---|---|---|---|--|--|--|--|
| Chk.Six-PA-32 | 3,400 | 50 | S | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Seneca-II | 4,570 | 55 | S | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Aztec-D | 5,200 | 46 | S | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 |
| Baron-E-55 | 5,424 | 56 | S | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Navajo-C | 6,536 | 66 | S | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| GrnCaravanCE208B | 8,750 | 75 | S | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Air Tractor 502 | 9,000 | 98 | S | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 |
| Citation 525 | 10,500 | 98 | S | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Air Tractor 802 | 14,200 | 130 | S | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Citation-550B | 15,000 | 130 | S | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Citation-V | 16,500 | 130 | S | 6 | 7 | 7 | 7 | 6 | 7 | 7 | 7 |
| Sabreliner-40 | 19,035 | 185 | S | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Sabreliner-60 | 20,372 | 214 | S | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Shorts 360 | 27,200 | 78 | S | 7 | 9 | 10 | 11 | 9 | 9 | 9 | 9 |
| KingAir B-100 | 11,500 | 52 | D | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 |
| SuperKingAir-B200 | 12,590 | 98 | D | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 |
| SuperKingAir-300 | 14,100 | 92 | D | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 4 |
| Super King Air-350 | 15,100 | 92 | D | 3 | 3 | 4 | 5 | 4 | 4 | 4 | 4 |
| Learjet-55 | 21,500 | 201 | D | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 |
| Hawker-800 | 27,520 | 135 | D | 7 | 7 | 8 | 9 | 8 | 8 | 9 | 9 |
| Falcon-2000 | 35,000 | 197 | D | 9 | 10 | 11 | 11 | 11 | 11 | 12 | 12 |
| Falcon-50 | 38,800 | 208 | D | 10 | 11 | 12 | 13 | 13 | 13 | 13 | 14 |
| Falcon-900 | 45,500 | 145 | D | 12 | 13 | 14 | 15 | 14 | 15 | 15 | 16 |
| Challenger-CL-604 | 48,200 | 145 | D | 12 | 12 | 14 | 16 | 14 | 14 | 15 | 15 |
| Gulfstream-G-II | 66,000 | 160 | D | 18 | 20 | 21 | 22 | 21 | 22 | 23 | 23 |
| Gulfstream-G-IV | 75,000 | 185 | D | 22 | 24 | 25 | 25 | 26 | 26 | 27 | 28 |

¹Configuration of the main gear: S = single wheel and D = dual wheel (as defined in FAA Order 5300.7, *Standard Naming Convention for Aircraft Landing Gear Configurations*).

PCNs

The PCN is assigned to a pavement and expresses the relative load carrying capacity of that pavement in terms of allowable load for unrestricted operations based on aircraft departures (frequency and weight) and pavement layer properties. The determined PCN is specific for the given conditions and should be recalculated if the aircraft types or volumes change significantly. As with the ACN, the PCN has a minimum value of 0 and has no upper limit. In addition to the numerical value, the PCN is reported with four codes, which represent the following categories:

- Pavement Type
 - R = Rigid
 - F = Flexible
- Subgrade Strength Category
 - A = High (k-value ≥ 442 psi/in or CBR ≥ 13)
 - B = Medium (221 psi/in $<$ k-value < 442 psi/in or $8 <$ CBR < 13)
 - C = Low (92 psi/in $<$ k-value ≤ 221 psi/in or $4 <$ CBR ≤ 8)
 - D = Ultra Low (k-value ≤ 92 psi/in or CBR ≤ 4)
- Maximum Allowable Tire Pressure
 - W = Unlimited (no pressure limit)
 - X = High (pressure limited to 254 psi)
 - Y = Medium (pressure limited to 181 psi)
 - Z = Low (pressure limited to 73 psi)
- Pavement Evaluation Method
 - T = Technical Evaluation
 - U = Using Aircraft Evaluation

General Overload Guidance

For aircraft with an ACN that exceeds the PCN, ICAO overload guidance can be referenced. Alternatively, aircraft with ACNs greater than the PCNs for analyzed facilities may be able to safely use these pavements (following the ACN–PCN procedure) by operating at a reduced weight. If these aircraft do not operate at their analyzed weight (as shown in Table 5), then the PCN should be recalculated using the operating weights. That said, aircraft would need to be restricted to these analyzed weights to avoid the potential for damaging the pavement.

In general, for flexible pavements, aircraft with ACNs in excess of 10 percent of the reported PCN should be restricted from operating on the given facility to avoid potential damage to the pavement. For rigid pavements, aircraft with ACNs in excess of 5 percent of the reported PCN should be restricted. Exceeding this recommendation may result in a reduced pavement life. Appendix D of the FAA Advisory Circular 150/5335-5C presents the following guidance for pavement overloads (taken from ICAO Aerodrome Design Manual, 1983):

- For flexible pavements, occasional traffic cycles by aircraft with an ACN not exceeding 10 percent above the reported PCN should not adversely affect the pavement.
- For rigid or composite pavements, occasional traffic cycles by aircraft with an ACN not exceeding 5 percent above the reported PCN should not adversely affect the pavement.

- The annual number of overload traffic cycles should not exceed approximately 5 percent of the total annual aircraft traffic cycles. [As additional guidance, the FAA recommends limiting the overload cycles to 500 coverages; the corresponding number of annual departures depends on the aircraft and its typical pass to coverage ratio.]
- Overloads should not normally be permitted on pavements exhibiting signs of load-related distress, during periods of thaw following frost penetration, or when the strength of the pavement or its subgrade could be weakened by water.

Where overload operations are conducted, the airport/agency should regularly monitor the condition of the affected pavement and periodically review the criteria for overload operations since excessive repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of the pavement. In general, pavement overloads are expected to decrease pavement life but do not often cause immediate or catastrophic failures unless they are excessive.

PCN ANALYSIS INPUTS

The analysis approach using COMFAA, the FAA's software, uses the same methodology as the FAA's conventional design procedure outlined in the FAA Advisory Circular 150/5320-6D, *Airport Pavement Design and Evaluation*. It incorporates the CBR design procedure for flexible pavements, which determines the required thickness of pavement layers to protect the underlying layers from rutting. For rigid pavements, the design procedure is based on the Westergaard solution for a loaded elastic plate on a Winkler foundation to limit cracking in the PCC pavement.

The aircraft data, subgrade support values (CBR for flexible pavement or effective top-of-base k-value for rigid pavement), and pavement evaluation thicknesses are used directly in COMFAA. For rigid pavements, the PCC flexural strength is also a direct input. Using these inputs, COMFAA iteratively adjusts the critical aircraft weight until the required pavement thickness determined using the software matches the existing pavement cross section. This process is repeated within COMFAA such that each aircraft in the mix is analyzed as the critical aircraft. This calculation produces a PCN associated with each analyzed aircraft; in general, the highest PCN associated with the "regularly using" aircraft is selected to represent the section.

Pavement and Subgrade Layer Properties

As previously mentioned, Section 01 of the runway was reconstructed in 2012, while Section 02 was constructed in 1990 as a runway extension. Pavement cross section information (material types and thicknesses) for Runway 14-32 Section 01 were obtained from the 2012 construction plans and FAA Form 5100 pavement design documentation. The subgrade k-value of 125 psi/in was also obtained from the 2012 construction records. Table 4 indicates different values for rigid pavement because it represents the effective top-of-base k-values. A flexural strength of 650 psi was conservatively selected and was used in this analysis.

Pavement construction details are not available for Section 02, such that the cross section is unknown and a technical evaluation of the PCN cannot be calculated for this specific portion of the runway. The remainder of this report focuses on the technical calculation for Section 01, which makes up the majority of Runway 14-32, with consideration of what the PCN would be for Section 02 based on the Using Aircraft Evaluation Method to determine the PCN (presented later in this report).

Detailed work history information for each pavement section, as it is entered in the APMS PAVER database, is presented in Appendix D of the complementary Pavement Management Report for this airport. A summary of the relevant layer thickness information for the PCN analysis is presented in Table 3.

Table 3. Pavement cross section information.

| Branch ¹ | Section ¹ | Construction Date | Layer Thickness, in | Material Type |
|---------------------|----------------------|-------------------|---------------------|-------------------|
| R14AU | 01 | 6/3/2012 | 6 | PCC (P-501) |
| R14AU | 01 | 6/3/2012 | 4 | Aggregate (P-209) |
| R14AU | 02 | 6/1/1990 | Unknown | Unknown |

¹ See Figure A-1 located in Appendix A for the location of the branch and section.

The pavement evaluation thickness used for calculating PCNs is determined differently for flexible and rigid pavements. Furthermore, the subgrade strength used for rigid pavement PCN analysis is also determined differently than for flexible pavement. These inputs are listed in Table 4 for each analyzed pavement section; a brief explanation on how these inputs are determined is described in the following paragraphs.

Table 4. Pavement evaluation thickness and subgrade strength for COMFAA analysis.

| Branch ¹ | Section ¹ | Evaluation Thickness, in | Pavement Type | Subgrade Top-of-Base k-value, psi/in | Subgrade Category |
|---------------------|----------------------|--------------------------|---------------|--------------------------------------|-------------------|
| R14AU | 01 | 6 | R | 166 | C |
| R14AU | 02 | Unknown ² | R | 166 ³ | C ³ |

¹ See Figure A-1 located in Appendix A for the location of the branch and section.

² Unknown cross section information.

³ Subgrade properties for Section 02 are assumed to be similar to Section 01.

For flexible pavement, the evaluation thickness used for the PCN calculation is based on converting the existing pavement layers to a reference FAA cross section using FAA-recommended layer equivalency factors, as defined in the FAA Advisory Circular 150/5335-5C. Because there are no aircraft in the traffic mix with four or more wheels on a main gear (i.e., analyzed aircraft are limited to S or D gear types), the following standard FAA cross section is used: 3-inch HMA layer (P-401) on a 6-inch high-quality granular base layer (P-209 or similar). The FAA's COMFAA Support Spreadsheet was used to compute the evaluation thickness, which is a direct input in the PCN analysis. The subgrade strength in terms of a CBR is also a direct input into the PCN calculation for flexible pavements.

For rigid pavement, the thickness of the PCC layer is used as the evaluation thickness. In addition to the PCC layer thickness, the PCC flexural strength is also a direct input for PCN analysis of rigid pavement. Base layers are taken into account by converting to a top-of-base k-value (i.e., adjusting the support conditions) rather than contributing to the overall evaluation thickness. The FAA's COMFAA Support Spreadsheet is used to determine the top-of-base k-value used in the PCN analysis.

For composite pavements analyzed as rigid structures, the thickness of the HMA surface is converted to an equivalent PCC thickness and combined with the PCC thickness to compute the evaluation thickness (where 2.5 inches of HMA is considered to be equivalent to 1 inch of PCC, following FAA guidance).

Traffic

The traffic data provide a representation of the aircraft using each facility and are an estimate of the 20-year average annual departures. Only departures are used for the analysis following the FAA's procedure because they generally have heavier loads due to fuel weight. When actual operating weights of aircraft were not specified, maximum takeoff weights (MTOW) are used, which incorporates some conservatism into the analysis. The entire aircraft traffic mix associated with each facility is entered directly into COMFAA. Because PCN calculations are dependent on the aircraft using a facility, PCNs should be recalculated if the aircraft mix or volume changes significantly.

As previously stated, APTech compiled a representative traffic mix for use in the PCN analysis based on available information. The traffic data for Runway 14-32 was determined through a review of publicly available data. This information is presented in Table 5 along with the corresponding ACNs (as determined using COMFAA) for the pavement types and subgrade strength categories associated with Audubon County Airport.

Table 5. Traffic data.

| Aircraft | Weight, lbs | Gear Type ¹ | Tire Pressure, psi | Annual Departures for Runway 14-32 | ACN: Rigid Pavement, Subgrade Category C |
|--------------------|-------------|------------------------|--------------------|------------------------------------|--|
| Skyhawk-172 | 2,558 | S | 50 | 1,200 | 1 |
| Navajo-C | 6,536 | S | 66 | 1,200 | 2 |
| Air Tractor 502 | 9,000 | S | 98 | 1,200 | 3 |
| Air Tractor 802 | 14,200 | S | 130 | 250 | 6 |
| Citation-550B | 15,000 | S | 130 | 150 ² | 6 |
| Super King Air-350 | 15,100 | D | 92 | 150 | 4 |

¹ Defined by the configuration of the main gear: S = single wheel and D = dual wheel (as defined in FAA Order 5300.7, *Standard Naming Convention for Aircraft Landing Gear Configurations*).

² Departure volumes were increased to correspond to at least 1,000 coverages in order to report a PCN that accounts for regular use of this aircraft..

To account for back-taxiing needs, the FAA's PCN analysis allows the number of aircraft passes per traffic cycle to be increased. A pass to traffic cycle (P/TC) ratio of one was used in most cases with a standard runway and parallel taxiway configuration. A P/TC ratio of two was used for runways with a mid-field taxiway configuration, which would require aircraft to back-taxi prior to takeoff. A P/TC ratio of one was used for Runway 14-32 based on taxiway access to the approach end of Runway 32.

When the pavement capacity greatly exceeds the load applied by the aircraft in the analyzed traffic mix, analysis inputs are adjusted to attain a cumulative damage factor (CDF) of 0.15, per guidance in the FAA Advisory Circular 150/5335-5C. Additionally, PCNs are based on aircraft that regularly use a facility, where FAA Advisory Circular 150/5335-5C defines aircraft that regularly use the pavement as those with more than 1,000 coverages over the 20-year analysis period. As such, the reported PCNs are based on at least 1,000 coverages of the determining aircraft.

A coverage represents a full-load application on a point in the pavement to account for aircraft/pilot wander. The number of passes required to statistically “cover” the intended wheel path on the pavement is expressed by a pass to coverage (P/C) ratio (where a pass is a one-time movement of the aircraft over the pavement). The P/C ratio varies by aircraft, where smaller aircraft generally have more wander. Coverages were determined using COMFAA. Appendix A of the FAA Advisory Circular 150/5335-5C provides more detailed definitions regarding traffic terminology.

PCN RESULTS

The PCN determined for Section 01 of Runway 14-32 is presented in Table 6 along with the corresponding allowable aircraft weight (as determined using the FAA’s COMFAA support spreadsheet, which are approximations and are not specific for any particular aircraft model). While a PCN could not be calculated using the FAA’s Technical Evaluation Method for Section 02, the value based on the Using Aircraft Evaluation Method is presented for consideration. PCNs can be reported to the FAA’s regional office using the results from this report and/or the information in the standard FAA form provided in Appendix B; which contains the applicable 5010 data elements.

Table 6. PCN results and corresponding allowable aircraft weights.

| Branch ¹ | Section ¹ | PCN | Single Wheel ² Allowable Aircraft Weight, lbs |
|---------------------|----------------------|-----------|--|
| R14AU | 01 | 8/R/C/W/T | 25,500 |
| R14AU | 02 | 6/R/C/W/U | 19,500 |

¹ See Figure A-1 located in Appendix A for the location of the branch and section.

² Refers to the aircraft’s main gear type.

The PCN for Section 01 of Runway 14-32 is 8/R/C/W/T, indicating that this portion of the runway is structurally adequate for the traffic listed in Table 5.

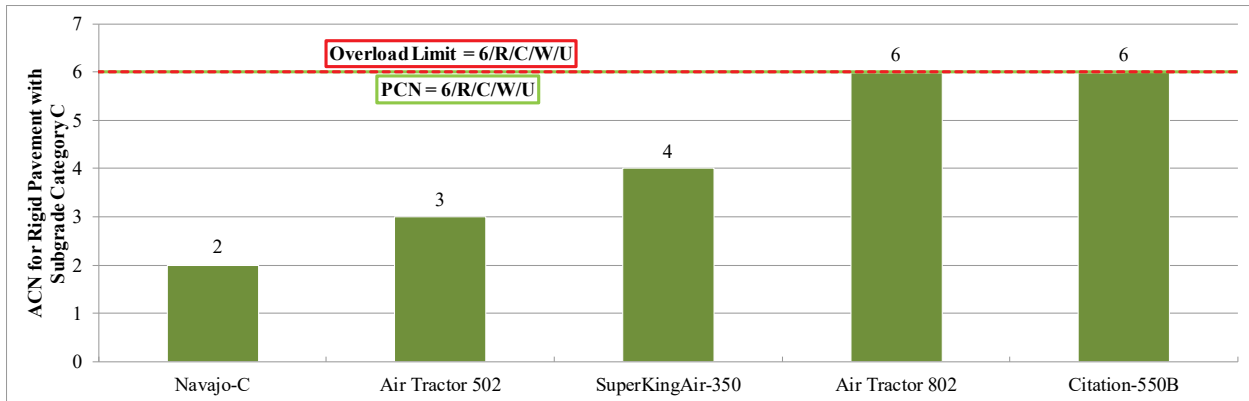
In order to determine PCNs using a technical approach, pavement cross section, subgrade strength, and aircraft traffic data are required. However, this information was not available for Section 02 and pavement testing was not included as part of this project to be able to obtain pavement or subgrade layer properties. As an alternative approach, the Using Aircraft Evaluation Method can be applied to determine PCNs where required inputs for a technical calculation are not available. If the Using Aircraft Evaluation Method is considered to determine the PCN for Section 02, the PCN would be reported as 6/R/C/W/U based on the ACN of the most demanding aircraft in the traffic mix. It may be that Section 02 has equal or greater capacity than Section 01, but the required cross section information is not available to evaluate this. While the FAA Advisory Circular states a concern regarding the Using Aircraft Evaluation Method, a PCN of 6/R/C/W/U is recommended to be consistent with other reported values for Iowa airports. Additionally, there are load-related distresses present in Section 02 that could indicate the current traffic overloads this area of the runway; the progression of distress should continue to be monitored. If information on the pavement cross section for Section 02 is obtained, the PCN can be re-evaluated.

The Airport may choose to report the PCN associated with Section 01 because this section makes up the majority of the runway and has a PCN that is based on a technical evaluation. If decision makers for the Audubon County Airport desire to be more conservative, a PCN of 6/R/C/W/U can be published. Regardless of which PCN is published, the current traffic would continue to be permitted to use this runway, as illustrated in Figure 1.

As previously indicated, in order to avoid over-reporting, the pavement’s load bearing capacity, the PCN calculation procedure outlined in the FAA Advisory Circular 150/5335-5C limits the PCN based on the ACNs associated with the analyzed aircraft. Therefore, if the traffic mix changes, the PCN should be recalculated. Furthermore, if the cross-section information for

Runway 14-32 Section 02 becomes available, APTech recommends reassessing the PCN for the runway.

Figure 1. ACN–PCN comparison for Runway 14-32.



The discussion presented herein is based on a straightforward comparison between ACNs (for the aircraft at their analyzed weights) and PCNs for each pavement section. The ICAO overload guidance, included in the ACN–PCN Overview chapter of this report, can be referenced for aircraft with an ACN that exceeds the PCN for a specified pavement. Alternatively, aircraft with ACNs greater than the PCNs for analyzed facilities may be able to safely use these pavements, following the ACN–PCN procedure, by operating at a reduced weight.

In general, pavement overloads are expected to decrease pavement life but do not often cause immediate or catastrophic failures unless they are excessive. While the FAA’s pavement structural capacity approach is conservative, where overload operations are conducted, Audubon County Airport should be aware of the effect and risks of operating these aircraft based on the PCN analysis results determined using the Technical Evaluation Method.

SUMMARY

This report presents an overview of the ACN–PCN procedure, summarizes the inputs used for the calculation (including the subgrade strength, PCC flexural strength where applicable, pavement evaluation thickness, and traffic), and documents the results of the PCN analysis. Additionally, ACNs of common aircraft are provided, and overload guidance is presented. In general, pavement overloads are expected to decrease pavement life but do not often cause immediate or catastrophic failures unless they are excessive.

The PCNs presented within this document are determined as described in the FAA Advisory Circular 150/5335-5C. Where the required inputs are available, a Technical Evaluation Method is completed while the FAA’s Using Aircraft Evaluation Method is considered where data for a technical evaluation are not available. The PCN associated with Section 01 is 8/R/C/W/T, which is based on a technical evaluation and indicates this section is structurally adequate for the analyzed aircraft. The PCN for Section 02 is 6/R/C/W/U, based on the ACN of the most demanding aircraft in the traffic mix. The PCN recommended for publication for Runway 14-32 is the lower of these values (6/R/C/W/U) to be conservative and to be consistent with other reported values for Iowa airports. Additional details are presented within the report.

REFERENCES

AirNav, LLC. 2018. "Airport Information." www.airnav.com.

ASTM International. 2013. "Standard Test Method for Airport Pavement Condition Index Surveys." ASTM Designation D5340-12. *Annual Book of ASTM Standards, Volume 12*. ASTM International, West Conshohocken, PA.

Federal Aviation Administration (FAA). 1995. *Airport Pavement Design and Evaluation*. Advisory Circular 150/5320-6D. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2005. *Standard Naming Convention for Aircraft Landing Gear Configurations*. Order 5300.7. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2014. *Airport Pavement Management Program (PMP)*. Advisory Circular 150/5380-7B. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2014. *Guidelines and Procedures for Maintenance of Airport Pavements*. Advisory Circular 150/5380-6C. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2014. *Standardized Method of Reporting Airport Pavement Strength - PCN*. Advisory Circular 150/5335-5C. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2016. *Airport Pavement Design and Evaluation*. Advisory Circular 150/5320-6F. U.S. Department of Transportation, Federal Aviation Administration, Washington, DC.

Federal Aviation Administration (FAA). 2018. "Traffic Flow Management System Counts (TFMSC)." aspm.faa.gov.

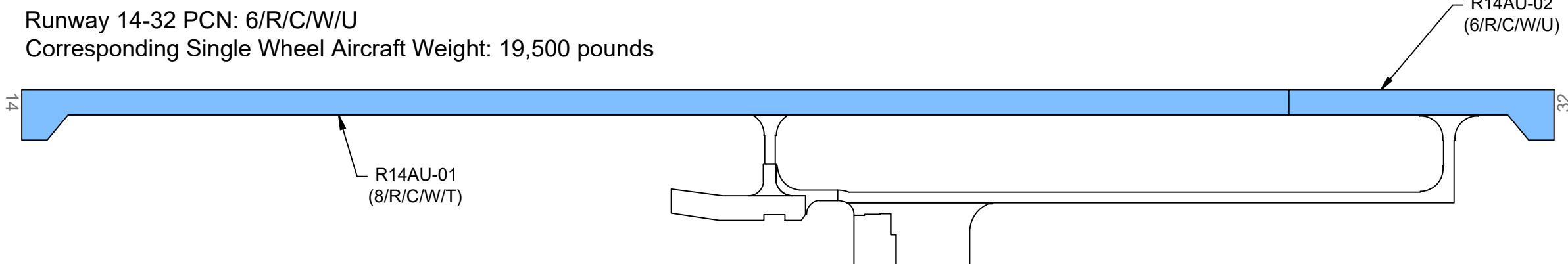
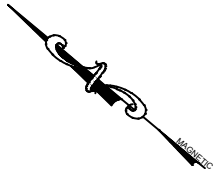
International Civil Aviation Organization (ICAO). 1983. *Aerodrome Design Manual, Part 3 – Pavements*. ICAO 9157-AN/901 Part 3, Second Edition. International Civil Aviation Organization, Montreal, Quebec, Canada.

International Civil Aviation Organization (ICAO). 1999. *International Standards and Recommended Practices: Aerodromes - Annex 14 to the Convention on International Civil Aviation*. Third Edition. International Civil Aviation Organization, Montreal, Quebec, Canada.

Appendix A

PCN Section Identification Map

FIGURE A-1. PCN Section Identification Map



LEGEND

BRANCH IDENTIFIER
 SECTION IDENTIFIER
 PCN VALUE
 SECTION BREAK LINE
 PCN SECTION

| | | | |
|---|----------------------------------|---|----------------------------|
| | | 115 W. Main Street, Suite 400 Urbana, IL 61801 Tel: (217) 398-3977 Fax: (217) 398-4027 | |
| | | 322 1st Street East Independence, IA 50644 Tel: (319) 334-7211 | |
| AGENCY: Iowa Department of Transportation Office of Aviation | | | |
| LOCATION: Audubon County Airport Audubon, Iowa | | | |
| PAGE TITLE: PCN Section Identification Map | | | |
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Appendix B

FAA Form 5010 Data Elements



PREPARED FOR

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