

# Southeast Iowa Regional Airport

Pavement Classification Number Report

**TECHNICAL EVALUATION METHOD**



## **PREPARED BY**

Applied Pavement Technology, Inc.  
115 West Main Street, Suite 400  
Urbana, Illinois 61801  
(217) 398-3977  
[www.appliedpavement.com](http://www.appliedpavement.com)

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# **SOUTHEAST IOWA REGIONAL AIRPORT PAVEMENT CLASSIFICATION NUMBER REPORT TECHNICAL EVALUATION METHOD**

*PREPARED FOR:*

**IOWA DEPARTMENT OF TRANSPORTATION  
AVIATION BUREAU**

*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, Aviation Bureau (Iowa DOT), Applied Pavement Technology, Inc. (APTech) determined Pavement Classification Numbers (PCNs) for runway pavements at Southeast Iowa Regional Airport and other airports included in the 2018 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 Southeast Iowa Regional 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, APTech compiled a representative traffic mix for use in the PCN analysis through a review of publicly available data and input from Airport Managers.

APTech used the collected information to determine the PCNs for each included pavement section in accordance with 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 sectioning is consistent with the nomenclature 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 pavement that was analyzed at Southeast Iowa Regional 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:

- 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 Southeast Iowa Regional Airport are summarized in Table 1.

Table 1. PCI results.

Branch <sup>1</sup>	Section <sup>1</sup>	Surface Type <sup>2</sup>	Last Construction Date	2018 PCI	Deduct due to Load-Related Distress, %	Load-Related Distress Observed <sup>3</sup>
R12BR	01	PCC	6/1/1998	94	8	LTD Cracking
R12BR	02	PCC	6/1/1998	86	0	None
R12BR	03	APC	6/1/2005	52	24	Rutting
R12BR	04	APC	6/1/2005	53	0	None
R18BR	01	APC	6/1/2005	40	0	None
R18BR	02	APC	6/1/2005	44	0	None

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

<sup>2</sup>AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.

<sup>3</sup>Distress types are defined by ASTM D5340-12.

Runway 12/30 Sections 01 and 02 were last rehabilitated 21 years ago with PCC pavement, and although both sections are the same age, Section 01 has higher PCI with a minor amount of load-related distress observed. Runway 18/36 Sections 01 and 02 and portions of Runway 12/30 at the runways' intersection (Sections 03 and 04) were overlaid with HMA pavement in 2005 and have similar PCIs with load-related distress noted on Runway 12/30 Section 03.

## ACN–PCN OVERVIEW

The ACN–PCN system of reporting pavement strength was developed by the International Civil Aviation Organization (ICAO). Because 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 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 the FAA’s COMFAA 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 <sup>1</sup>	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
King Air B-100	11,500	52	D	1	2	2	3	2	2	2	3
Super King Air-B200	12,590	98	D	2	3	3	4	3	3	3	4
Super King Air-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

<sup>1</sup>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*).

## 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  $\geq 442$  psi/in or CBR  $\geq 13$ )
  - B = Medium (221 psi/in  $<$  k-value  $< 442$  psi/in or  $8 <$  CBR  $< 13$ )
  - C = Low (92 psi/in  $<$  k-value  $\leq 221$  psi/in or  $4 <$  CBR  $\leq 8$ )
  - D = Ultra Low (k-value  $\leq 92$  psi/in or CBR  $\leq 4$ )
- 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 Tables 5 and 6), 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 FAA Advisory Circular 150/5335-5C presents the following guidance for pavement overloads (ICAO 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.
- When overload operations are conducted, the airport owner should regularly inspect the pavement condition. The airport owner should periodically review the criteria for overload operations. Excessive repetition of overloads can cause a significant reduction in pavement life or accelerate when a pavement will require a major rehabilitation.

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 the FAA's COMFAA software uses the same methodology as the FAA's conventional design procedure outlined in 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

All sections of Runway 12/30 were initially constructed with PCC pavement in 1944 and overlaid with a thin layer of HMA pavement in 1977. Sections 01 and 02 were overlaid with PCC pavement (unbonded) in 1998 and Sections 03 and 04 with HMA pavement in 2005.

Runway 18/36 Section 01, the majority of the runway, was constructed with PCC pavement in 1944 and overlaid with HMA pavement in 1970, 1977, and 2005. Section 02 was constructed as an extension in 1968 with PCC pavement and overlaid with HMA pavement in 2005.

Pavement cross section information (material types and thicknesses) for Runway 12/30 was obtained from 1956 and 1977 FAA pavement design documentation and a 2017 coring summary. Information for Runway 18/36 Section 01 was obtained from 1956 and 1977 FAA pavement design documentation and a 2017 coring summary and for Section 02 from 1968 FAA pavement strength documents and a 2017 coring summary. PCC thickness obtained from 2017 cores for Runway 12/30 Sections 03 and 04 and Runway 18/36 Sections 01 and 02 differs from the PCC thickness provided in design documentation; as such, PCC thickness from the cores was used in the PCN analysis. A subgrade k-value of 100 psi/in was obtained from the 1968 design records for Runway 18/36 extension and was assumed to be similar for all sections of both runways. Table 4 indicates various k-values for rigid pavement sections because it presents the effective top-of-base k-values (accounting for different base layers and thicknesses), which are used directly in the analysis. A flexural strength of 650 psi was conservatively selected and used in this analysis.

Detailed work history information for each pavement section is entered in the APMS PAVER database. A summary of the relevant layer thickness information for the PCN analysis is presented in Table 3.

Table 3. Pavement cross section information.

Branch <sup>1</sup>	Section <sup>1</sup>	Construction Date	Layer Thickness, in	Material Type
R12BR	01	6/1/1998	6	PCC (P-501)
R12BR	01	6/1/1977	2	HMA (P-401) <sup>2</sup>
R12BR	01	6/1/1944	8	PCC (P-501)
R12BR	02	6/1/1998	6	PCC (P-501)
R12BR	02	6/1/1977	2	HMA (P-401) <sup>2</sup>
R12BR	02	6/1/1944	8	PCC (P-501)
R12BR	03	6/1/2005	2 <sup>3</sup>	HMA (P-401)
R12BR	03	6/30/1977	2 <sup>3</sup>	HMA (P-401)
R12BR	03	6/1/1944	7.9	PCC (P-501)
R12BR	04	6/1/2005	2 <sup>3</sup>	HMA (P-401)
R12BR	04	6/30/1977	2 <sup>3</sup>	HMA (P-401)
R12BR	04	6/1/1944	7.8	PCC (P-501)
R18BR	01	6/1/2005	2 <sup>3</sup>	HMA (P-401)
R18BR	01	6/30/1977	3 <sup>3</sup>	HMA (P-401)
R18BR	01	6/1/1970	3 <sup>3</sup>	HMA (P-401)
R18BR	01	6/1/1944	8.4	PCC (P-501)
R18BR	02	6/1/2005	4.2	HMA (P-401)
R18BR	02	6/3/1968	9.5	PCC (P-501)
R18BR	02	6/2/1968	10	Aggregate (P-154)

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

<sup>2</sup>Thin HMA layer that performs as bond breaker layer; not included in the PCN analysis.

<sup>3</sup>Per 2017 cores, the total HMA thickness for Runway 18/36 Section 01 is 8.4-in; for Runway 12/30 Section 03 is 4.4-in; and for Runway 12/30 Section 04 is 5-in. PCC thicknesses from cores for these sections are as shown in this table.

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 <sup>1</sup>	Section <sup>1</sup>	Evaluation Thickness, in	Pavement Type	Top-of-Base k-value, psi/in	Subgrade Category
R12BR	01	6 / 8 <sup>2</sup>	R	100	C
R12BR	02	6 / 8 <sup>2</sup>	R	100	C
R12BR	03	9.7	R	100	C
R12BR	04	9.8	R	100	C
R18BR	01	10.8	R	100	C
R18BR	02	11.2	R	175	C

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

<sup>2</sup>Unbonded PCC overlay. Pavement structural evaluated using FAARFIELD.

For flexible pavements (which were not analyzed at this airport but were presented for completeness), 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 FAA Advisory Circular 150/5335-5C. When 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 pavements, 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 accounted for by converting to a top-of-base k-value (i.e., adjusting the support conditions) rather than contributing to the overall evaluation thickness. Pavement underlying a PCC overlay was analyzed as a stabilized base. 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. In cases where actual operating weights of aircraft are not specified, maximum takeoff weights (MTOW) are used, and this process 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 Runways 12/30 and 18/36 were determined through a review of publicly available data and supplemental input from the Airport Manager. 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 Southeast Iowa Regional Airport.

Table 5. Traffic data.

Aircraft	Weight, lbs	Gear Type <sup>1</sup>	Tire Pressure, psi	Annual Departures for Runway 18/36	Annual Departures for Runway 12/30	ACN: Rigid Pavement, Subgrade Category C
Piper Malibu Meridian	4,340	S	55	532	228	1
Chancellor 414	6,750	S	66	21	6	2
GrnCaravan CE-208	8,000	S	75	1,047	262	3
Phenom 100	10,582	S	98	8	2	4
Beechjet 400	16,300	S	105	13	4	6
Lockheed F-16	37,500	S	125	25		15
Boeing B-17 Flying Fortress	65,000	2D	100	25		24
Beechcraft 1900	17,120	D	171	1	1	5
Learjet 60	22,750	D	201	16	4	8
Hawker 800	28,000	D	135	9	3	9
Citation X	36,100	D	189	4	1	13
Falcon 50	38,800	D	208	5	2	14
Falcon 900	49,000	D	145	7	2	16
Falcon F7X	70,000	D	105	2		20
Gulfstream IV	74,600	D	185	2	1 <sup>2</sup>	27
Gulfstream V	85,000	D	188	2 <sup>2</sup>		30

<sup>1</sup>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*).

<sup>2</sup>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 is used in most cases with a standard runway and parallel taxiway configuration. A P/TC ratio of two is 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 12/30 and Runway 18/36 based on each runway having a parallel taxiway.

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 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 FAA Advisory Circular 150/5335-5C provides detailed definitions regarding traffic terminology.

## PCN RESULTS

The PCNs associated with each included pavement section of Runways 12/30 and 18/36 are presented in Table 6 along with corresponding allowable aircraft weights (as determined using the FAA’s COMFAA support spreadsheet, which are approximations and are not specific for any particular aircraft model). 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 <sup>1</sup>	Section <sup>1</sup>	PCN	Single Wheel <sup>2</sup> Allowable Aircraft Weight, lbs	Dual Wheel <sup>2</sup> Allowable Aircraft Weight, lbs	Dual Tandem Wheel <sup>2</sup> Allowable Aircraft Weight, lbs
R12BR	01 <sup>3</sup>	Not controlling	N/A	N/A	-
R12BR	02 <sup>3</sup>	Not controlling	N/A	N/A	-
R12BR	03 <sup>3</sup>	24/R/C/X/T	67,000	84,000	-
R12BR	04 <sup>3</sup>	24/R/C/X/T	67,000	84,000	-
R18BR	01	30/R/C/X/T	81,000	101,000	175,000
R18BR	02	35/R/C/X/T	93,000	126,000	222,000

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

<sup>2</sup>Refers to the aircraft’s main gear type.

<sup>3</sup>This section is not structurally adequate to handle some of the operations of the analyzed Gulfstream.

The recommended PCN for Runway 12/30 is 24/R/C/X/T based on the structural capacity of the controlling pavement structure, Section 03 (with Section 04 being very similar). Figure 1 illustrates the extent to which the ACN of the analyzed aircraft (namely the Gulfstream IV) exceeds the calculated PCN. The detailed analysis indicates that the very limited operations (two annual departures) of the Gulfstream IV are acceptable without overloading the pavement; however, “regular” operations of this aircraft would result in overloading. FAA’s FAARFIELD program was used to assess the structural capacity of Sections 01 and 02 because of their unbonded PCC overlay construction. That analysis indicates that Sections 01 and 02 have a greater structural capacity than Sections 03 or 04, such that the PCN determined for Section 03 can be used for reporting the capacity of this runway. That analysis also verified that the limited annual departures of the Gulfstream IV listed in Table 5 do not cause overloading, but frequent operations would. Because load-related distress was observed on Sections 01 and 03 during the 2018 PCI inspection and this analysis indicates some overloading concerns, the condition of the runway pavement and the progression of distress should be monitored.

The recommended PCN for Runway 18/36 is 30/R/C/X/T based on the structural capacity of the controlling pavement structure, Section 01. The PCN analysis indicates that the runway is structurally adequate for the traffic listed in Table 5, as illustrated in Figure 2.

Figure 1. ACN–PCN comparison for Runway 12/30.

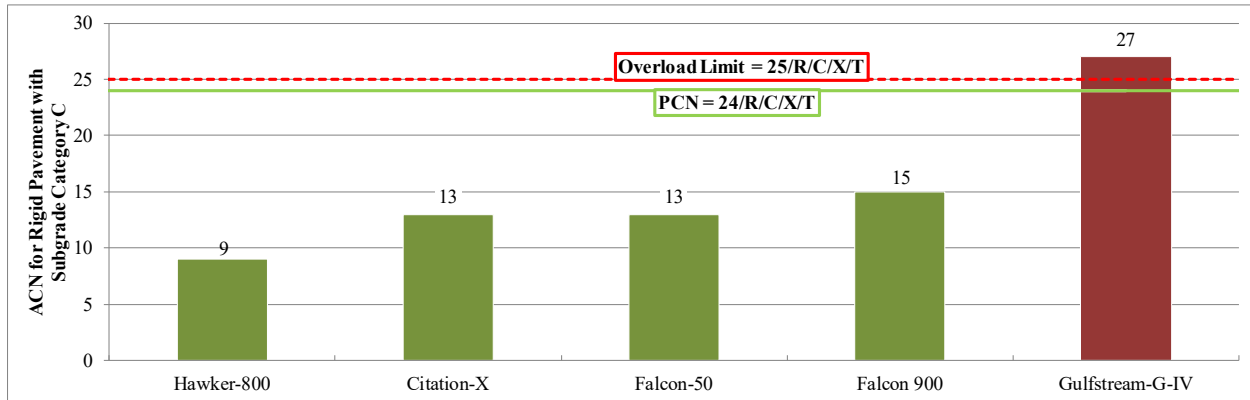
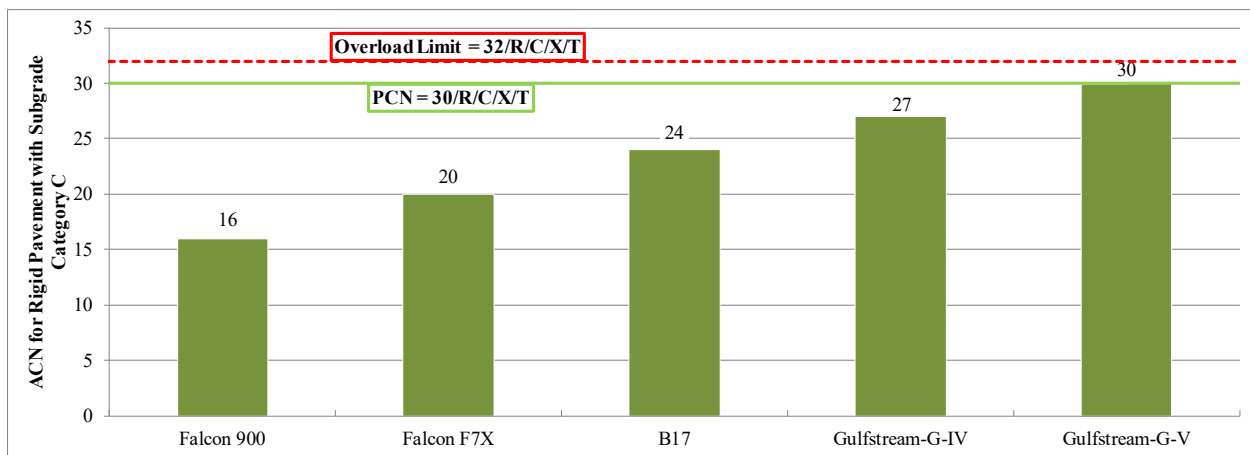


Figure 2. ACN–PCN comparison for Runway 18/36.



As previously indicated, in order to avoid over-reporting the pavement’s load-bearing capacity, the PCN calculation procedure outlined in 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.

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, Southeast Iowa Regional 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.

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## 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 calculated using the FAA’s Technical Evaluation Method for determining PCNs, as described in the FAA Advisory Circular 150/5335-5C. The PCNs recommended for publication are 24/R/C/X/T for Runway 12/30 and 30/R/C/X/T for Runway 18/36. Runway 12/30 pavement is not structurally adequate for “regular” operations of Gulfstream IV, which has an ACN exceeding the recommended PCN, but the detailed analysis indicates the runway pavement has adequate capacity for occasional use of this aircraft (two departures a year).



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## REFERENCES

AirNav, LLC. 2018. “Airport Information.” [www.airnav.com](http://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.

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

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

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.

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.

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

FAA. 2018. “Traffic Flow Management System Counts (TFMSC).” [aspm.faa.gov](http://aspm.faa.gov).

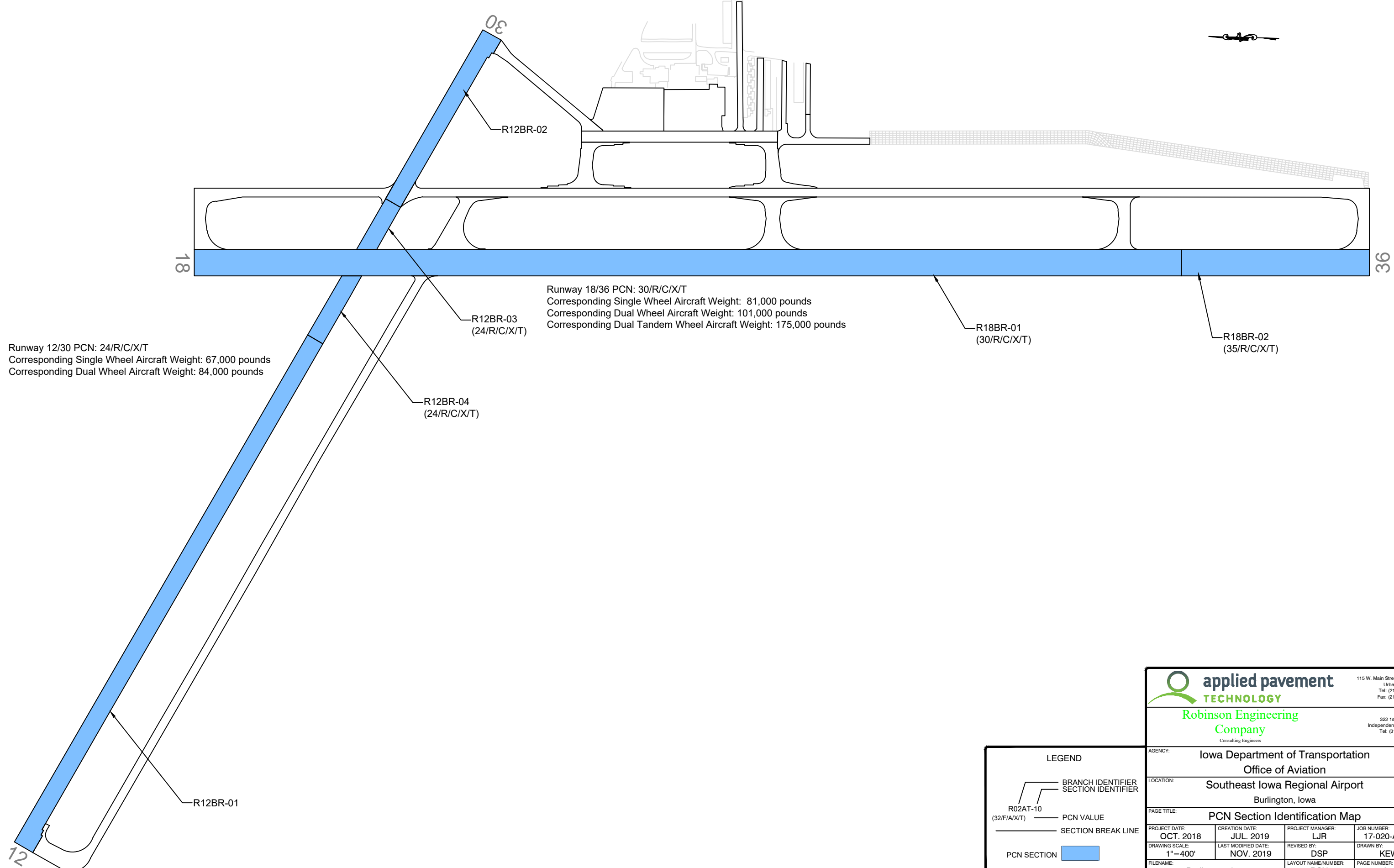
International Civil Aviation Organization (ICAO). 1983. *Aerodrome Design Manual: Pavements*. ICAO 9157-AN/901 Part 3, Second Edition. International Civil Aviation Organization, Montreal, Quebec, Canada.

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



		115 W. Main Street, Suite 400 Urbana, IL 61801 Tel: (217) 396-3977 Fax: (217) 396-4027	
		322 1st Street East Independence, IA 50644 Tel: (319) 334-7211	
AGENCY: Iowa Department of Transportation Office of Aviation			
LOCATION: Southeast Iowa Regional Airport Burlington, Iowa			
PAGE TITLE: PCN Section Identification Map			
PROJECT DATE: OCT. 2018	CREATION DATE: JUL. 2019	PROJECT MANAGER: LJR	JOB NUMBER: 17-020-AM02
DRAWING SCALE: 1" = 400'	LAST MODIFIED DATE: NOV. 2019	REVISED BY: DSP	DRAWN BY: KEW
FILENAME: Burlington.dwg		LAYOUT NAME/NUMBER: PCN	PAGE NUMBER: A-1

**LEGEND**

BRANCH IDENTIFIER  
 SECTION BREAK LINE  
 PCN SECTION

PCN VALUE

## **APPENDIX B**

### **FAA FORM 5010 DATA ELEMENTS**





**PREPARED FOR**

Iowa Department of Transportation  
Aviation Bureau  
800 Lincoln Way  
Ames, Iowa 50010  
515-239-1691  
[www.iowadot.gov/aviation](http://www.iowadot.gov/aviation)

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