

# Forest City Municipal Airport

Pavement Classification Number Report

**USING AIRCRAFT METHOD**



**PREPARED BY**

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# **FOREST CITY MUNICIPAL AIRPORT PAVEMENT CLASSIFICATION NUMBER REPORT USING AIRCRAFT METHOD**

*PREPARED FOR:*

**IOWA DEPARTMENT OF TRANSPORTATION  
AVIATION BUREAU**

*PREPARED BY:*

**APPLIED PAVEMENT TECHNOLOGY, INC.**

October 2020

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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 9/27 and Runway 15/33 at Forest City Municipal Airport.

PCNs can be calculated using the Technical Evaluation Method or the Using Aircraft Method. The Technical Evaluation Method requires information on pavement cross-section and subgrade strength as well as aircraft data, whereas the Using Aircraft Method is based only on aircraft traffic data. The Iowa DOT and the Federal Aviation Administration (FAA) chose to use the Using Aircraft Method for this phase of the project.

Through a review of publicly available data (specifically from FAA's Traffic Flow Management System Counts [TFMSC] obtained from [aspm.faa.gov](http://aspm.faa.gov) and overall operational volumes from [airnav.com](http://airnav.com)) and input from Airport Managers, APTech compiled representative traffic data for use in determining the associated PCN. Each aircraft type using a pavement has an associated Aircraft Classification Number (ACN), with the ACNs determined using the FAA's COMFAA 3.0 software. The largest ACN associated with an aircraft regularly using the facility was reported as the PCN. Additional considerations are presented under the PCN Determination heading in this report.

This report includes a general overview of the Aircraft Classification Number–Pavement Classification Number (ACN–PCN) system; relevant information regarding the Pavement Condition Index (PCI) results, especially regarding load-related distress; 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(2018), *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 2019 Individual Airport 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 Forest City Municipal Airport are summarized in Table 1.

Table 1. PCI results.

Branch	Section	Surface Type	Last Construction Date	2019 PCI	Deduct due to Load-Related Distress, %	Load-Related Distress Observed
R09FC	01	AAC	6/1/2004	58	0	None
R09FC	02	AAC	6/1/2004	62	0	None
R09FC	03	AAC	6/1/2004	66	0	None
R09FC	04	AAC	6/1/2007	75	0	None
R15FC	01	AAC	8/1/2007	52	19	Alligator Cracking
R15FC	02	AAC	8/1/2007	53	11	Alligator Cracking

Table Notes:

1. See Figure A-1 located in Appendix A for the location of the branch and section.
2. Surface Type: AC = asphalt cement concrete; AAC = asphalt overlay on AC; PCC = portland cement concrete; APC = asphalt overlay on PCC.
3. Distress types are defined by ASTM D5340-12(2018).

Runway 9/27 consists of four sections. Sections 01 and 02 are located to the west of Runway 15/33, Section 03 at the Runway 27 Approach, and Section 04 adjacent to Runway 15/33. All

four sections were initially constructed with HMA pavement in 1974 and overlaid with HMA pavement in 2004. Section 04 received an additional HMA pavement overlay in 2007. No sections on Runway 9/27 contain load-related distress. Runway 15/33 is comprised of two similarly sized sections. Section 01 is the north-western portion of the runway and was originally constructed with HMA pavement in 1969 and has received HMA pavement overlays in 1974, 1991, and 2007. Section 02, the south-eastern portion of the runway, was originally constructed with HMA pavement in 1974 and received HMA pavement overlays in 1991 and 2007. Both sections on Runway 15/33 contain load-related distress. Available work history information for Runways 9/27 and 15/33 is entered in the APMS PAVER database. A summary of available construction information is presented in Table 2.

Table 2. Pavement cross section information.

Branch	Section	Construction Date	Layer Thickness, in	Material Type
R09FC	01	6/1/2004	2.25	HMA (P-499)
R09FC	01	6/2/1974	1	HMA (P-401)
R09FC	01	6/1/1974	5	Bituminous Base (P-201)
R09FC	02	6/1/2004	2.25	HMA (P-499)
R09FC	02	6/2/1974	4	HMA (P-401)
R09FC	02	6/1/1974	5	Bituminous Base (P-201)
R09FC	03	6/1/2004	2.25	HMA (P-499)
R09FC	03	6/2/1974	1	HMA (P-401)
R09FC	03	6/1/1974	5	Bituminous Base (P-201)
R09FC	04	6/1/2007	Unknown	HMA
R09FC	04	6/1/2004	2.25	HMA (P-499)
R09FC	04	6/2/1974	1	HMA (P-401)
R09FC	04	6/1/1974	5	Bituminous Base (P-201)
R15FC	01	8/1/2007	Unknown	HMA
R15FC	01	6/1/1991	2	HMA (P-401)
R15FC	01	6/1/1974	3	HMA (P-401)
R15FC	01	6/2/1969	1.5	HMA (P-401)
R15FC	01	6/1/1969	5	Bituminous Base (P-201)
R15FC	02	8/1/2007	Unknown	HMA
R15FC	02	6/1/1991	2	HMA (P-401)
R15FC	02	6/2/1974	4	HMA (P-401)
R15FC	02	6/1/1974	4	Bituminous Base (P-201)

Table Notes:

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

## 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 for each subgrade strength category. 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 3 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 ACNs 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 3. ACNs for common aircraft by pavement type and subgrade category (not specific to this airport).

Aircraft	Weight, lbs	Tire Pressure, psi	Gear Type	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
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	62	S	2	3	3	4	3	3	3	3
Citation 525	10,500	98	S	4	4	4	4	4	4	4	4
Air Tractor 802	14,200	62	S	3	5	5	6	4	4	5	5
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-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

## Table Notes:

1. 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. Ideally, the PCN will be determined based on aircraft departures (frequency and weight) along with any pavement and subgrade layer properties. If these data become available, APTech recommends a technical evaluation be completed to determine the PCN.

FAA Advisory Circular 150/5335-5C states the following regarding the Using Aircraft Method of reporting PCNs:

*The accuracy of this method is greatly improved when aircraft traffic information is available. Significant over-estimation of the pavement capacity can result if an excessively damaging aircraft, which uses the pavement on a very infrequent basis, is used to determine the PCN. Likewise, significant under-estimation of the pavement capacity can lead to uneconomic use of the pavement by preventing acceptable traffic from operating. Use of the Using Aircraft Method is discouraged on a long-term basis due to the concerns listed above.*

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. 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 DETERMINATION—USING AIRCRAFT METHOD

Aircraft traffic is the primary consideration when reporting a PCN following the Using Aircraft Method. The PCN is reported based on the pavement type (rigid or flexible) corresponding to a given subgrade category. For the Using Aircraft Method, the specific strength is not required, but a subgrade category should be specified so the corresponding ACN can be referenced. The subgrade strength category C was chosen based on recent design documentation for other facilities at this airport and was assumed to be similar for Runways 9/27 and 15/33.

APTech compiled traffic data to provide a representation of the aircraft using Runways 9/27 and 15/33 based on publicly available information and FAARFIELD inputs taken from recent apron design documentation. This information was provided to the Airport Manager for review, who noted that the traffic was representative of the aircraft using Runways 9/27 and 15/33 and provided additional input regarding frequency of some of the heavier aircraft. Representative traffic information is presented in Tables 4 and 5 along with the corresponding ACNs (as determined using COMFAA) for the pavement types and subgrade strength categories associated with Forest City Municipal Airport.

Table 4. Runway 15/33 traffic data.

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Flexible Pavement, Subgrade Category C
Piper Cherokee	2,150	S	50	1
Cessna 182 Skylane	3,100	S	50	1
Beech Bonanza 36	3,600	S	52	1
Cessna 425 Corsair	8,600	S	75	3
Air Tractor 502	9,000	S	62	3
Air Tractor 802	14,200	S	62	5
Cessna Citation Bravo	15,100	S	130	6
Cessna Excel/XLS	20,200	S	214	9
SuperKingAir B200	12,590	D	98	3
Learjet 60	23,500	D	168	8
Hawker 800	27,520	D	135	8
Gulfstream G200	35,450	D	208	11
Challenger 604*	48,200	D	145	14

Table Notes:

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*).
- \* Aircraft excluded from traffic for PCN analysis due to infrequent operations and is included in this table for reference only.

Table 5. Runway 9/27 traffic data.

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Flexible Pavement, Subgrade Category C
Piper Cherokee	2,150	S	50	1
Cessna 182 Skylane	3,100	S	50	1
Beech Bonanza 36	3,600	S	52	1
Cessna 425 Corsair	8,600	S	75	3
Air Tractor 502	9,000	S	62	3
Single Wheel 12.5 (unspecified)	12,500	S	50	4

## Table Notes:

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*).

Based on the aircraft using Runway 15/33 and considering input from the Airport Manager regarding frequency of operations, it is recommended that the PCN based on the Gulfstream G200, which has an ACN of 11 for a flexible pavement with subgrade category C. This is reported as the PCN in Table 6 with corresponding weights also listed. Based on the representative aircraft using Runway 9/27, of which the most demanding representative aircraft is the Single Wheel 12.5 (unspecified) with an ACN of 4 for the given pavement type and subgrade category, the PCN and corresponding allowable aircraft weights are presented in Table 6. The corresponding allowable aircraft weights were determined using the FAA's COMFAA Support Spreadsheet, which are approximations and are not specific for any particular aircraft model. The PCNs can be reported to the FAA's regional office using the results from this report.

Table 6. PCN results and corresponding allowable aircraft weights.

Branch	PCN	Single Wheel Allowable Aircraft Weight, lbs	Dual Wheel Allowable Aircraft Weight, lbs
Runway 9/27	4/F/C/X/U	12,500	N/A
Runway 15/33	11/F/C/X/U	31,000	47,000

## Table Notes:

1. Single or dual wheel allowable aircraft weight refers to the aircraft's main gear type.
2. Corresponding allowable weight for dual wheel aircraft is not provided by the FAA if it is less than 37,500 lbs.

No load-related distresses were observed on Runway 9/27 during the 2019 PCI inspection; however, the pavement condition should continue to be monitored on this runway. Load-related distresses were observed during the 2019 PCI inspection on Runway 15/33, which indicates that some aircraft may be overloading the pavement. Therefore, additional investigation is recommended to determine a more accurate assessment of the capacity of the runway. Furthermore, the overall pavement condition and progression of distress should continue to be monitored.

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, although this

information is more applicable for PCNs determined from a Technical Evaluation Method. Alternatively, aircraft with ACNs greater than the documented PCN may be able to use the facility, 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.

## SUMMARY

This report presents an overview of the ACN–PCN procedure and documents the representative traffic considered when determining the PCN following the FAA’s Using Aircraft Method, as described in FAA Advisory Circular 150/5335-5C. The PCN recommended for publication for Runway 15/33 is 11/F/C/X/U and for Runway 9/27 is 4/F/C/X/U. No load-related distresses were observed during the 2019 PCI inspection on Runway 9/27; however, they were observed on Runway 15/33, which indicates that some aircraft may be overloading this pavement.

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.

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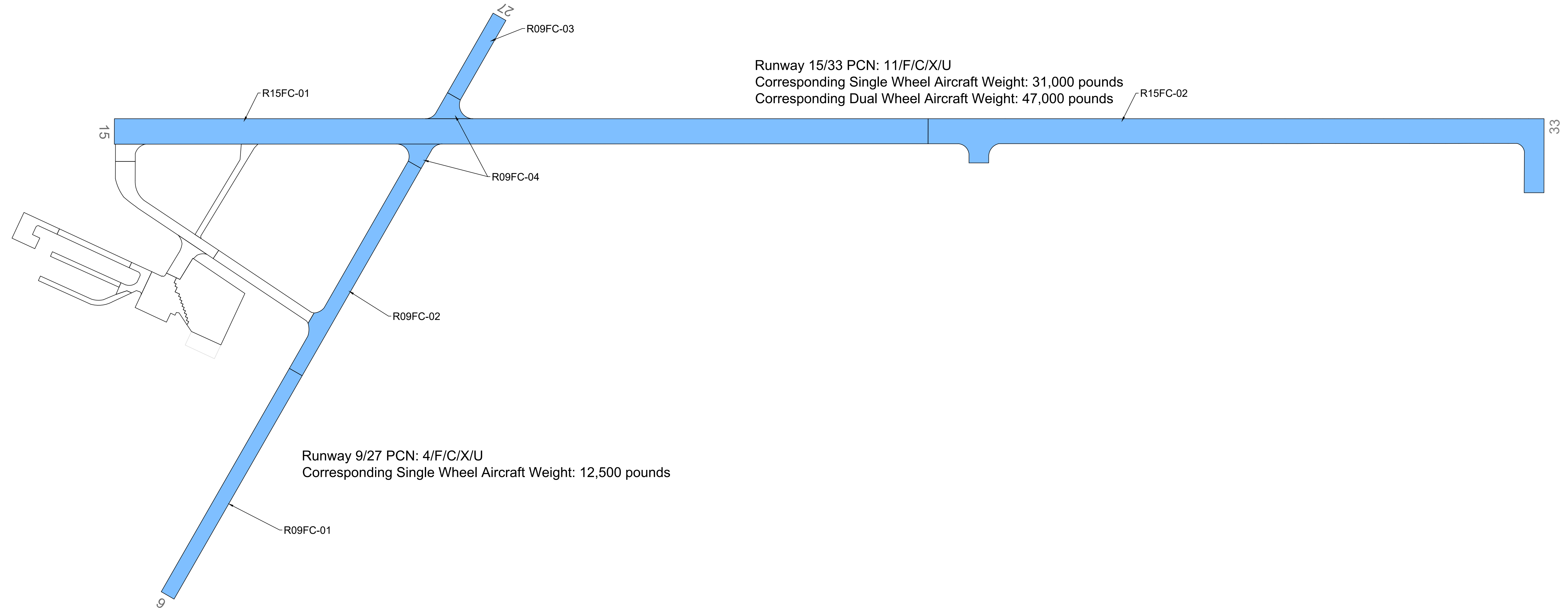
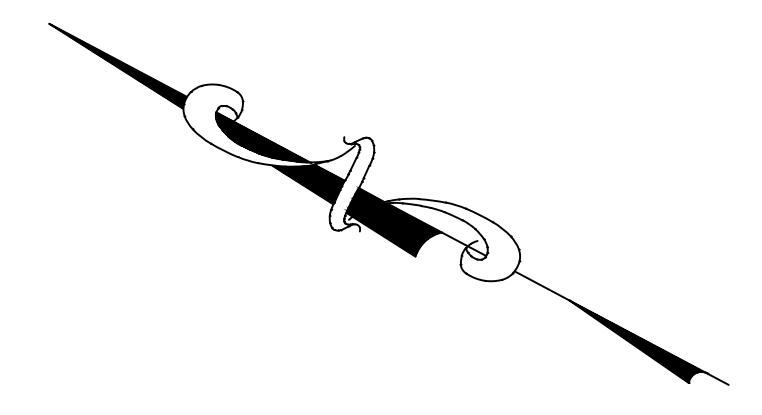
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## **APPENDIX A**

### **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) 998-3977 Fax: (217) 998-4027	
		322 First Street East Independence, Iowa 50644 319-334-7211	
AGENCY: Iowa Department of Transportation Office of Aviation			
LOCATION: Forest City Municipal Airport Forest City, Iowa			
PAGE TITLE: PCN Section Identification Map			
PROJECT DATE: OCT. 2019	CREATION DATE: OCT. 2019	PROJECT MANAGER: LJR	JOB NUMBER: 2017-020-AM03
DRAWING SCALE: 1" = 200'	LAST MODIFIED DATE: OCT. 2020	REVISED BY: KEW	DRAWN BY: KEW
FILENAME: Forest City.dwg		LAYOUT NAME/NUMBER: PCN	PAGE NUMBER: A-1

## **APPENDIX B**

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

Figure B-1. Form 5010 Data Elements  
(Standard Form from the FAA’s Support Spreadsheet for COMFAA 3.0).

A Flexible Category (CBR 15)  
 B Flexible Category (CBR 10)  
 C Flexible Category (CBR 6)  
 D Flexible Category (CBR 3)

**TIRE PRESSURE**  
 W Unlimited  
 X 218 psi  
 Y 145 psi  
 Z 73 psi

**METHOD USED**  
 Using Aircraft  
 Technical

**Project info**

A Rigid Category (k 552 pci)  
 B Rigid Category (k 295 pci)  
 C Rigid Category (k 147 pci)  
 D Rigid Category (k 74 pci)

**AIRCRAFT GEAR TYPE IN TRAFFIC MIX**  
 S (single wheel gear)       3D (triple tandem wheel gear) e.g B-777  
 D (dual wheel gear)       DDT or W/B (tandem gear under wing AND tandem gear under body) e.g. B-747, A-340-600, A-380  
 2D (dual tandem wheel gear)

**Enter PCN:**

**Form 5010 Gross weight and PCN**  

Data Element	Gross weight and PCN
#35 S gear	
#36 D gear	
#37 DT gear	
#38 DDT gear	
#39 PCN	

**IF 3D or W/B Gear Checked, #38 = PCN**  

	PCN
3D	
2D/2D2	
2D/3D2W	
2D/3D2B	

Please Add Data Element #38 Remark

**Save Form 5010 Data**

**Clear Data**

Airport LOC-ID	Pavement ID	#35 S GW	#36 D GW	#37 DT GW	#38 DDT GW	#39 PCN
FXY	Runway 9/27	12.5				4/F/C/X/U
FXY	Runway 15/33	31	47			11/F/C/X/U



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**OCTOBER 2020**