

# Davenport Municipal Airport

Pavement Classification Number Report

**USING AIRCRAFT METHOD**



**PREPARED BY**

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**OCTOBER 2020**



# **DAVENPORT 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

The preparation of this document was financed in part through an Airport Improvement Program grant from the Federal Aviation Administration (Project Number 3-19-0000-026-2019) as provided under Section 505 of the Airport and Airway Improvement Act of 1982, as amended. The contents do not necessarily reflect the DOT's official views or the policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate the proposed development is environmentally acceptable in accordance with appropriate public laws.

## TABLE OF CONTENTS

Introduction .....	1
Pavement Condition Summary.....	2
ACN–PCN Overview .....	4
ACNs .....	4
General Overload Guidance .....	6
PCN Determination—Using Aircraft Method .....	8
Summary.....	11
References.....	12

## LIST OF TABLES

Table 1. PCI results.....	2
Table 2. Pavement cross section information.....	3
Table 3. ACNs for common aircraft by pavement type and subgrade category (not specific to this airport). .....	5
Table 4. Runways 3/21 and 15/33 traffic data .....	8
Table 5. PCN results and corresponding allowable aircraft weights.....	9

## APPENDIXES

Appendix A. PCN Section Identification Map .....	A-1
Appendix B. FAA Form 5010 Data Elements .....	B-1

## 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 3/21 and Runway 15/33 at Davenport 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 Davenport 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
R03DA	01	PCC	6/3/2015	98	0	None
R15DA	01	PCC	4/3/2019	100	0	None
R15DA	02	PCC	6/30/1994	97	0	None
R15DA	03	PCC	6/3/2015	98	0	None

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 3/21 was reconstructed with PCC pavement in 2015 and does not contain any load-related distress. Runway 15/33 consists of three sections. Section 01 represents pavement located at the Runway 15 Approach and mid-way on the runway, Section 02 is located at the Runway 33 Approach, and Section 03 is adjacent to Runway 3/21. Section 02 is the oldest pavement

constructed in 1994 with PCC pavement. All sections have similar PCIs and no sections contain load-related distress. Available work history information for Runways 3/21 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.

<b>Branch</b>	<b>Section</b>	<b>Construction Date</b>	<b>Layer Thickness, in</b>	<b>Material Type</b>
R03DA	01	6/3/2015	8	PCC (P-501)
R03DA	01	6/2/2015	8	Aggregate (P-209)
R15DA	01	6/3/2019	10	PCC (P-501)
R15DA	01	6/2/2019	12	Recycled Concrete Aggregate (P-219)
R15DA	01	6/1/2019	9	Cement-Treated Subgrade (P-301)
R15DA	02	6/30/1994	10	PCC (P-501)
R15DA	02	6/29/1994	4	Aggregate (P-209)
R15DA	02	6/28/1994	4	Aggregate (P-154)
R15DA	03	6/3/2015	10	PCC (P-501)
R15DA	03	6/2/2015	6	Aggregate (P-209)

Table Notes:

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

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## 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. It appears that the subgrade strength category B was used in Runway 15/33 design documentation (discussed in more detail later in this chapter) that also provided a PCN for the recently reconstructed section. The subgrade strength category B is assumed for both runways for PCN reporting.

APTech compiled traffic data to provide a representation of the aircraft using Runways 3/21 and 15/33 based on publicly available information and data obtained from FAARFILED file taken from recent Runway 15/33 design documentation. This information was provided to the Airport Manager for review, who noted that the traffic was representative of the aircraft using the airport and provided additional input. Representative traffic information is presented in Table 4 along with the corresponding ACNs (as determined using COMFAA) for the pavement type and subgrade strength category associated with Davenport Municipal Airport.

Table 4. Runways 3/21 and 15/33 traffic data.

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category B
Skyhawk-172	2,558	S	50	1
Baron-E-55	5,424	S	56	2
Citation-525	10,500	S	98	4
BeechJet-400	15,500	S	90	5
SuperKingAir-300	14,100	D	92	4
SuperKingAir-350	15,100	D	92	4
Learjet-35A/65A	18,000	D	171	5
Learjet-55	21,500	D	201	7
Hawker-800	27,520	D	135	8
Falcon-2000	35,000	D	197	11
Citation X	36,000	D	189	12
Falcon-50	38,800	D	208	13
Falcon-900	41,000	D	145	13
Challenger-CL-604	45,790	D	145	13
Gulfstream-G-II	61,560	D	160	20
Gulfstream-G-III	66,215	D	175	22
Gulfstream-G-IV	70,870	D	185	25
Gulfstream-G-V	85,975	D	188	29
Gulfstream-G-V	87,020	D	188	29
A320-100*	90,900	D	200	23

Table 4. Runways 3/21 and 15/33 traffic data (continued).

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category B
DC9-32*	96,300	D	155	27
C-130*	96,300	2S	105	19

## Table Notes:

- Defined by the configuration of the main gear: S = single wheel, D = dual wheel, 2S = single tandem wheel (as defined in FAA Order 5300.7, *Standard Naming Convention for Aircraft Landing Gear Configurations*).
- \* Aircraft excluded from traffic in PCN analysis due to infrequent operations and is included in this table for reference only.

Based on the representative aircraft using Runways 3/21 and 15/33, of which the most demanding aircraft with somewhat frequent operations is the Gulfstream-G-V with an ACN of 29 for the given pavement type and subgrade category, the PCN and corresponding allowable aircraft weights based on the Using Aircraft Method are presented in Table 5. 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 5. PCN results and corresponding allowable aircraft weights.

Branch	PCN	Single Wheel Allowable Aircraft Weight, lbs	Dual Wheel Allowable Aircraft Weight, lbs	Dual Tandem Wheel Allowable Aircraft Weight, lbs
Runway 3/21	29/R/B/W/U	80,000	102,000	191,000
Runway 15/33	29/R/B/W/U	80,000	102,000	191,000

## Table Notes:

- Single or dual wheel allowable aircraft weight refers to the aircraft's main gear type.

Based on the aircraft using Runways 3/21 and 15/33, the resulting PCNs for these facilities per the Using Aircraft Method correspond with higher allowable aircraft weights when compared to currently published data. This PCN assessment is non-technical and is not a guarantee that the pavement is structurally adequate for this traffic. No load-related distresses were observed on the runways during the 2019 PCI inspection.

As previously mentioned, a separate PCN was completed in 2017 by McClure Engineering Company for a newly designed portion of Runway 15/33. That assessment appears to be based on a technical approach and concluded that the PCN of newly reconstructed portion of Runway 15/33 was 43 with a corresponding single wheel allowable aircraft loading of 110,000 pounds, dual wheel of 156,000 pounds, and dual tandem wheel of 265,000 pounds. It is APTEch's interpretation that the complete PCN for this portion of Runway 15/33 would be 43/R/B/W/T. The overall capacity of the runway is expected to be limited to the other, older sections of Runway 15/33, and were are assessed herein based on the Using Aircraft Method.

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.

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## 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 Runways 3/21 and 15/33 is 29/R/B/W/U. No load-related distresses were observed during the 2019 PCI inspection on the runways; however, the condition of the pavement should continue to be monitored.

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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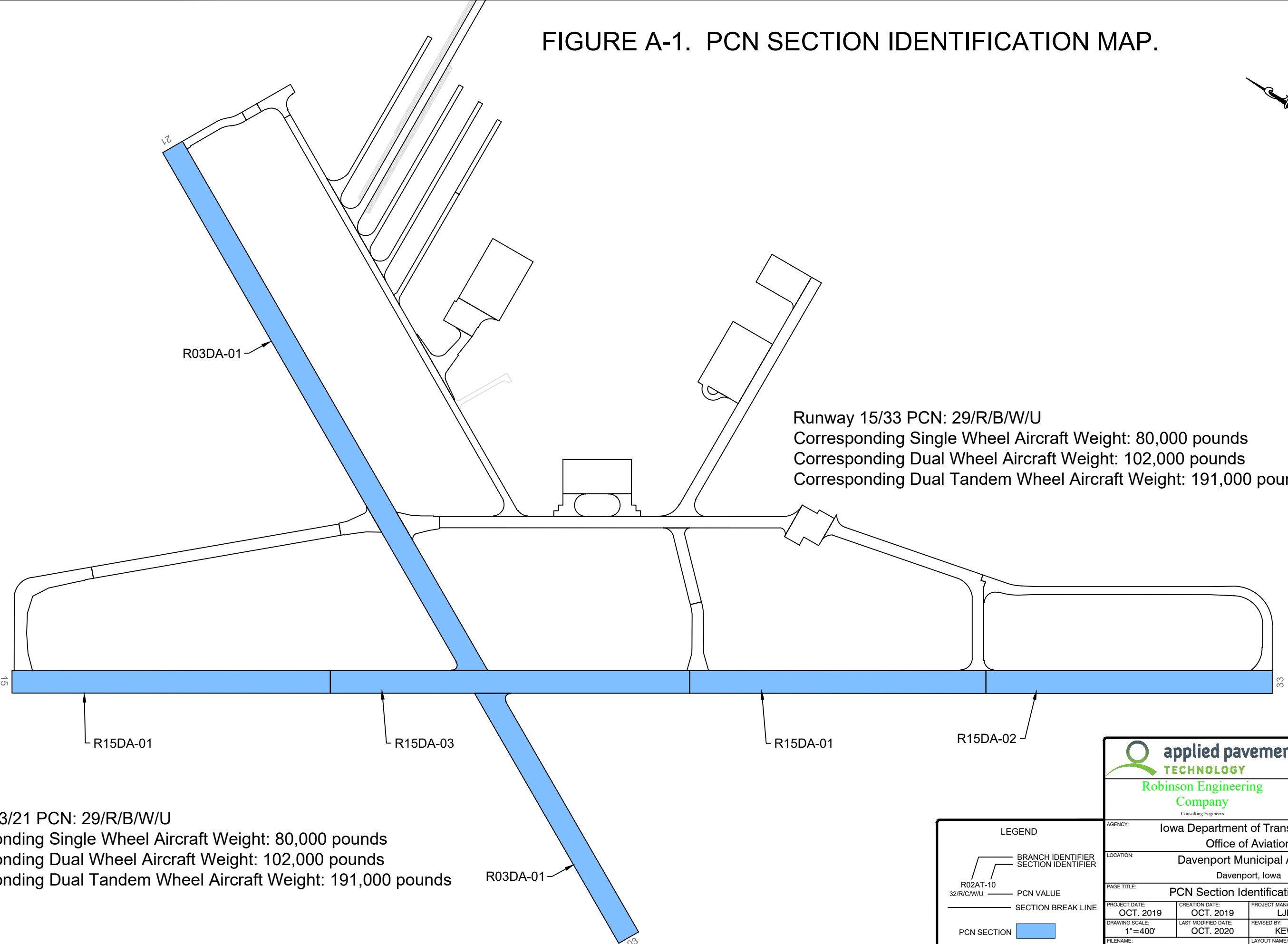
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## **APPENDIX A**

### **PCN SECTION IDENTIFICATION MAP**



FIGURE A-1. PCN SECTION IDENTIFICATION MAP.



Runway 3/21 PCN: 29/R/B/W/U  
 Corresponding Single Wheel Aircraft Weight: 80,000 pounds  
 Corresponding Dual Wheel Aircraft Weight: 102,000 pounds  
 Corresponding Dual Tandem Wheel Aircraft Weight: 191,000 pounds

Runway 15/33 PCN: 29/R/B/W/U  
 Corresponding Single Wheel Aircraft Weight: 80,000 pounds  
 Corresponding Dual Wheel Aircraft Weight: 102,000 pounds  
 Corresponding Dual Tandem Wheel Aircraft Weight: 191,000 pounds

LEGEND

- BRANCH IDENTIFIER SECTION IDENTIFIER
- PCN VALUE
- SECTION BREAK LINE
- PCN SECTION

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LOCATION: Davenport Municipal Airport Davenport, 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" = 400'	LAST MODIFIED DATE: OCT. 2020	REVISED BY: KEW	DRAWN BY: DSP
FILENAME: Davenport.dwg		LAYOUT NAME/NUMBER: PCN	PAGE NUMBER: A-1

## **APPENDIX B**

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





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**OCTOBER 2020**