Ottumwa Regional Airport

Pavement Classification Number Report

USING AIRCRAFT METHOD

PREPARED BY

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applied pavement TECHNOLOGY

OTTUMWA REGIONAL 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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TABLE OF CONTENTS

LIST OF TABLES

APPENDIXES

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 13/31 and Runway 4/22 at Ottumwa Regional 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 and overall operational volumes from 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 Ottumwa Regional 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
R13OT	01	PCC	6/3/2018	100	0	None
R04OT	01	APC	8/1/2009	62	0	None
R04OT	02	APC	8/1/2009	54	0	None
R04OT	03	AC	8/4/2009	64	0	None
R04OT	04	PCC	6/3/2018	100	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 13/31 was reconstructed with PCC pavement in 2018. Runway 4/22 consists of four sections. Section 01 is located at the Runway 4 Approach and was originally constructed with PCC pavement in 1960. It then received HMA overlays in 1986 and 2009. Section 02 is the

majority of Runway 4/22 and was originally constructed with PCC pavement in 1960. Section 02 has received HMA pavement overlays in 1970 and 2009. Section 03 is an extension located at the Runway 22 Approach and was constructed with HMA pavement in 2009. Section 04 is located adjacent to Runway 13/31 and was reconstructed with PCC pavement in 2018. Neither runway contains load-related distress. Available work history information for Runways 13/31 4/22 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
R13OT	01	6/3/2018	8.5	PCC (P-501)
R13OT	01	6/2/2018	8	Aggregate (P-209)
R04OT	01	8/1/2009	3	HMA (P-401)
R04OT	01	6/30/1986	2.5	HMA (P-401)
R04OT	01	6/1/1960	8	PCC (P-501)
R04OT	02	8/1/2009	3	HMA (P-401)
R04OT	02	6/30/1970	2.5	HMA (P-401)
R04OT	02	6/1/1960	9	PCC (P-501)
R04OT	03	8/4/2009	4	HMA (P-401)
R04OT	03	8/3/2009	12	Aggregate (P-209)
R04OT	03	8/2/2009	4	Reclaimed Aggregate
R04OT	04	6/3/2018	6	PCC (P-501)
R04OT	04	6/2/2018	4	Aggregate (P-209)

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 ≥ 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. 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. Following FAA guidance, the composite pavement type (HMA placed over PCC) is analyzed as rigid when the thickness of HMA layer is thinner than the thickness of underlying PCC layer or as flexible if HMA layer is thicker than the PCC layer. At Ottumwa Regional Airport Sections 01 and 02 of Runway 4/22 were analyzed as rigid sections. 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 D was chosen based on Runway 13/31 design documentation and was assumed to be similar for Runway 4/22.

APTech compiled traffic data to provide a representation of the aircraft using each runway. Traffic for Runway 4/22 was based on publicly available information while the traffic data for Runway 13/31 was obtained from the FAARFILED file taken from recent Runway 13/31 design documentation. This information was provided to the Airport Manager for review, who noted that the traffic was representative of the aircraft using Runway 13/31 and Runway 4/22. Specifically, the Airport Manager confirmed that the Challenger is the largest aircraft using Runway 4/22. In addition to the traffic used for the Runway 13/31 design, the Airport Manager noted that a Gulfstream 650 periodically uses this runway. 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 Ottumwa Regional Airport.

Table 4. Runway 13/31 traffic data.

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category D
Single Wheel-3	3,000	S	50	1
Single Wheel-5	5,000	S	46	1
KingAir-C-90	9,710	S	58	3
Single Wheel-10	10,000	S	98	4
Citation-550B	15,000	S	130	6
BeechJet-400	15,500	S	90	6
Citation-V	16,500	S	130	7
SuperKingAir-B200	12,590	D	98	4
SuperKingAir-300	14,100	D	92	4
LearJet-35A/65A	18,000	D	171	6
LearJet-55	21,500	D	201	7
Citation-VI/VII	23,200	D	168	8
Hawker-800XP	28,120	D	135	9
Falcon-2000	35,000	D	197	12
Citation-X	36,000	D	189	13

Table 4. Runway 13/31 traffic data (continued).

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category D
Falcon-50	38,800	D	208	14
Falcon-900	45,500	D	145	16
RegionalJet-200	47,450	D	177	18
Gulfstream-G500	90,900	D	188	33
Gulfstream-G650*	99,600	D	188	34

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*

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

Table 5. Runway 4/22 traffic data.

Representative Aircraft	Weight, lbs	Gear Type	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category D	ACN: Flexible Pavement, Subgrade Category D
Cessna 180	2,800	S	50	1	1
Piper PA-34	4,773	S	46	1	2
Cheyenne 1	8,700	S	75	3	3
Citation CJ3	13,870	S	130	5	6
Phenom 300	17,968	S	185	8	8
Cessna Excel/XLS	20,200	S	214	9	9
Beech Super King Air 350	15,100	D	92	4	5
Citation Sovereign	30,775	D	189	11	10
Challenger 300	38,850	D	208	14	13

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 representative aircraft using Runway 13/31, of which the most demanding representative aircraft is the Gulfstream-G500 with an ACN of 33, the PCN and corresponding allowable aircraft weights are presented in Table 6. The most demanding representative aircraft on Runway 4/22 is the Challenger 300 with an ACN of 13 for the flexible pavement type and ACN of 14 for the rigid pavement type for listed subgrade category. The resulting PCN and corresponding allowable aircraft weights presented in Table 6 are based on flexible pavement type which yield slightly more restrictive values. 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 13/31	33/R/D/W/U	87,000	107,000
Runway 4/22	13/F/D/X/U	34,500	46,000

Table Notes:

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

No load-related distresses were observed on Runways 13/31 and 4/22 during the 2019 PCI inspection; however, the pavement condition 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 13/31 is 33/R/D/W/U and for Runway 4/22 13/F/D/X/U. No load-related distresses were observed during the 2019 PCI inspection on either runway; 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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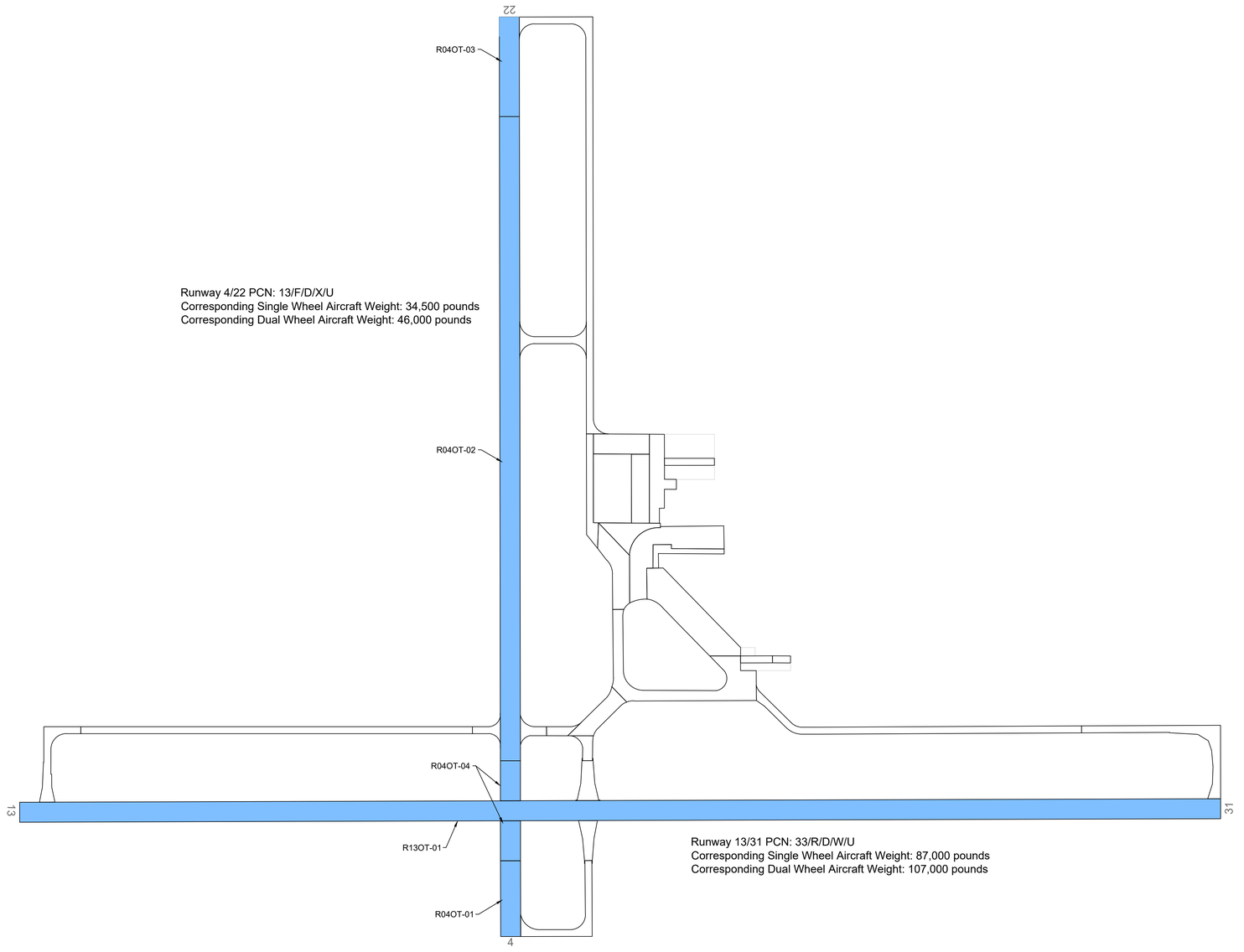
APPENDIX A

PCN SECTION IDENTIFICATION MAP

FIGURE A-1. PCN SECTION IDENTIFICATION MAP.



Runway 4/22 PCN: 13/F/D/X/U
Corresponding Single Wheel Aircraft Weight: 34,500 pounds
Corresponding Dual Wheel Aircraft Weight: 46,000 pounds

Runway 13/31 PCN: 33/R/D/W/U
Corresponding Single Wheel Aircraft Weight: 87,000 pounds
Corresponding Dual Wheel Aircraft Weight: 107,000 pounds

LEGEND

R02AT-10 — BRANCH IDENTIFIER / SECTION IDENTIFIER
32/R/C/W/U — PCN VALUE
SECTION BREAK LINE
PCN SECTION

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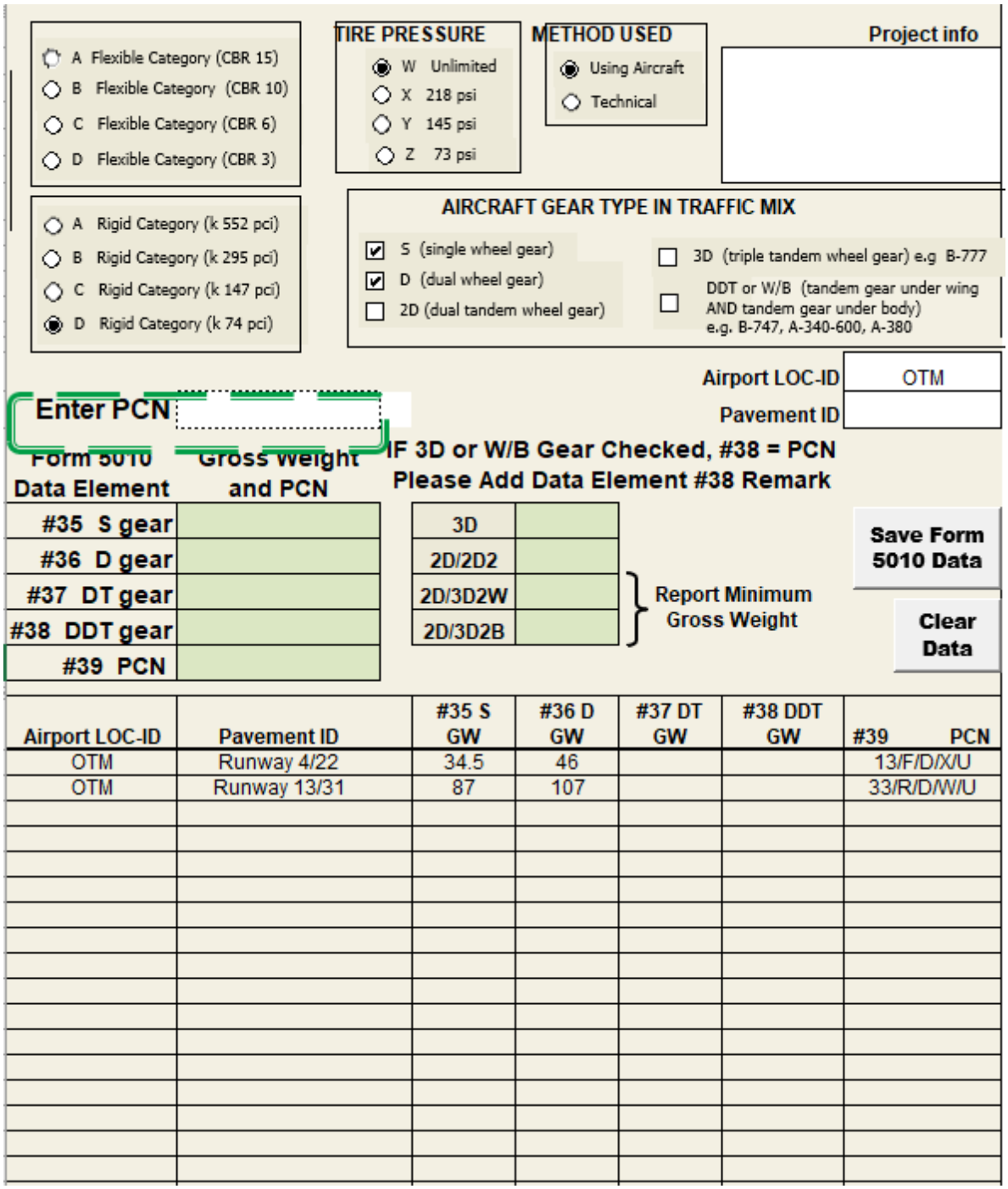
AGENCY: Iowa Department of Transportation, Office of Aviation			
LOCATION: Ottumwa Regional Airport, Ottumwa, Iowa			
PAGE TITLE: PCN Section Identification Map			
PROJECT DATE: OCT. 2019	CREATION DATE: OCT. 2019	PROJECT MANAGER: LJR	JOB NUMBER: 2017-020-AM03
DRAWING SCALE: 1"=300'	LAST MODIFIED DATE: OCT. 2020	REVISED BY: KEW	DRAWN BY: KEW
FILENAME: Ottumwa.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).



Airport LOC-ID	Pavement ID	#35 S GW	#36 D GW	#37 DT GW	#38 DDT GW	#39 PCN
OTM	Runway 4/22	34.5	46			13/F/D/X/U
OTM	Runway 13/31	87	107			33/R/D/W/U

PREPARED FOR

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