West Union Municipal — George L Scott Municipal Airport

Pavement Classification Number Report

USING AIRCRAFT METHOD

PREPARED BY

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WEST UNION MUNICIPAL-GEORGE L SCOTT MUNICIPAL AIRPORT

PAVEMENT CLASSIFICATION NUMBER REPORT USING AIRCRAFT METHOD

PREPARED FOR:

IOWA DEPARTMENT OF TRANSPORTATION
OFFICE OF AVIATION

PREPARED BY:

APPLIED PAVEMENT TECHNOLOGY, INC.

December 2018

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INTRODUCTION

As part of the airport pavement management system (APMS) update for the Iowa Department of Transportation, Office of Aviation (Iowa DOT), Applied Pavement Technology, Inc. (APTech) determined Pavement Classification Numbers (PCNs) for runway pavements at West Union Municipal-George L Scott Municipal Airport and the other airports included in the 2017 phase of the APMS update. The PCNs established as part of this project will help decision-makers from the Iowa DOT, the Federal Aviation Administration (FAA), and West Union Municipal-George L Scott Municipal 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.

In order to determine PCNs using a technical approach, pavement cross section, subgrade strength, and aircraft traffic data are required. The Iowa DOT, through collaboration with the FAA, provided design records, if available. However, this information was not available for all facilities, and pavement testing to obtain pavement or subgrade layer properties was not included as part of this project. As an alternative approach, the Using Aircraft Method is applied to determine runway PCNs where required inputs for a technical calculation are not available.

Through a review of publicly available data and input from Airport Managers, APTech compiled representative traffic data for consideration in determining the associated PCN. The largest Aircraft Classification Number (ACN) associated with an aircraft regularly using the facility is generally reported as the PCN, per the Using Aircraft Method outlined in the FAA Advisory Circular 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength – PCN*. ACNs were determined using the FAA's COMFAA 3.0 software. Additional considerations are presented under the PCN heading in this report.

The pavement sections are consistent with those identified as part of the APMS update and used for Pavement Condition Index (PCI) inspections, where sections are defined by attributes such as cross section, construction history, traffic use, and overall performance. The map included in Appendix A identifies these pavement sections at West Union Municipal-George L Scott Municipal 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; inputs for determining PCNs; and the resulting PCNs.

PAVEMENT CONDITION AND CONSTRUCTION SUMMARY

As part of the Iowa DOT statewide APMS project, APTech visually assessed the pavement using the PCI procedure. This procedure is described in the 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 Pavement Management Report for this airport.

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

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

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

Table 1. PCI results.

Branch[1]	Section[1]	Surface Type[2]	Last Construction Date	2017 PCI	Deduct due to Load-Related Distress, %	Load-Related Distress Observed[3]
R17WU	01	PCC	6/1/1988	71	25	Corner Break, LTD Cracking, Shattered Slab
R17WU	02	PCC	6/1/1975	57	70	Corner Break, LTD Cracking, Shattered Slab
R17WU	03	PCC	6/1/2007	97	35	LTD Cracking
R17WU	04	PCC	6/1/2007	79	20	Corner Break, LTD Cracking

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

[2]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

Runway 17-35 consists of four sections, with Section 02 representing the original runway pavement that was constructed with PCC in 1975. Section 01, a runway extension, was constructed 13 years later. As such, Section 02 has a lower PCI with more load-related distress.

Section 03 represents a runway widening on either side of the runway, and Section 04 is a turnaround located at the Runway 17 approach. The overall capacity of a runway is generally not restricted by these types of pavement sections, as they are not the primary trafficked portions of the facility. Their condition data are included for completeness.

Detailed work history information for each pavement section, as it is entered in the APMS PAVER database, is presented in Appendix D of the complementary Pavement Management Report for this airport. A summary of available construction information is presented in Table 2.

Table 2. Pavement cross section information.

Branch[1]	Section[1]	Construction Date	Layer Thickness, in	Material Type
R17WU	01	6/1/1988	Unknown	PCC[2]
R17WU	02	6/1/1975	Unknown	PCC[2]
R17WU	03	6/1/2007	6	PCC (P-505)
R17WU	03	6/2/2007	4	Aggregate (P-208)
R17WU	04	6/1/2007	6	PCC (P-505)
R17WU	04	6/1/2007	4	Aggregate (P-208)

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

[2]In addition to the PCC layer, information regarding any underlying base layers is unknown.

ACN–PCN OVERVIEW

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

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

ACNs

According to the FAA Advisory Circular 150/5335-5C, the ACN is defined as a number that expresses the relative effect of an aircraft at a given weight on a pavement structure for a specified standard subgrade strength. The ACN can be calculated for any operating weight. Higher ACNs indicate an aircraft has a more severe effect on the pavement, while lower values indicate a less severe effect. ACNs are reported by pavement type 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 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 3. ACNs for common aircraft by pavement type and subgrade category (not specific to this airport).

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

[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.

The FAA AC 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. If these aircraft do not operate at their analyzed weight, then the PCN should be determined using the operating weights.

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

- For flexible pavements, occasional traffic cycles by aircraft with an ACN not exceeding 10 percent above the reported PCN should not adversely affect the pavement.
- For rigid or composite pavements, occasional traffic cycles by aircraft with an ACN not exceeding 5 percent above the reported PCN should not adversely affect the pavement.
- The annual number of overload traffic cycles should not exceed approximately 5 percent of the total annual aircraft traffic cycles. [As additional guidance, the FAA recommends limiting the overload cycles to 500 coverages; the corresponding number of annual departures depends on the aircraft and its typical pass to coverage ratio.]
- Overloads should not normally be permitted on pavements exhibiting signs of load-related distress, during periods of thaw following frost penetration, or when the strength of the pavement or its subgrade could be weakened by water.

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

PCN 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 assigned based on another pavement project at this airport (corresponding with a subgrade k-value of 100 psi/in); specifically, it was obtained from FAA Form 5100 pavement design documentation for the 2007 construction of Runway 17-35 Sections 03 and 04.

As previously stated, APTech compiled traffic data to provide a representation of the aircraft using each runway based on publicly available information, including referencing currently published capacity data. This information was provided to the Airport Manager for review, who noted that the traffic was appropriate and provided additional input. Representative traffic information is presented in Table 4 along with the corresponding ACNs (as determined using COMFAA) for the pavement types and subgrade strength categories associated with this Airport. The aircraft listed are assumed to use Runway 17-35 on a regular basis.

Table 4. Traffic data.

Aircraft	Weight, lbs	Gear Type[1]	Tire Pressure, psi	ACN: Rigid Pavement, Subgrade Category C
Skyhawk-172	2,558	S	50	1
Navajo-C	6,536	S	66	2
Air Tractor 502	9,000	S	98	3
Cheyenne III	11,200	S	95	4
Air Tractor 802	14,200	S	130	6
Citation-550B	15,000	S	130	6
Citation CJ4	17,110	S	130	7
Super King Air-350	15,100	D	92	4

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

Based on the representative aircraft using Runway 17-35, the PCN and 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) are presented in Table 5. This PCN 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 5. PCN result and corresponding allowable aircraft weight.

Runway	PCN	Single Wheel[1] Allowable Aircraft Weight, lbs
Runway 17-35	7/R/C/W/U	22,500

[1]Refers to the aircraft's main gear type.

Load-related distresses were observed on all sections during the 2017 PCI inspection, 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; the overall 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 the FAA Advisory Circular 150/5335-5C. The PCN recommended for publication is 7/R/C/W/U for Runway 17-35. Load-related distresses were observed during the 2017 PCI inspection, which indicates that some aircraft may be overloading the 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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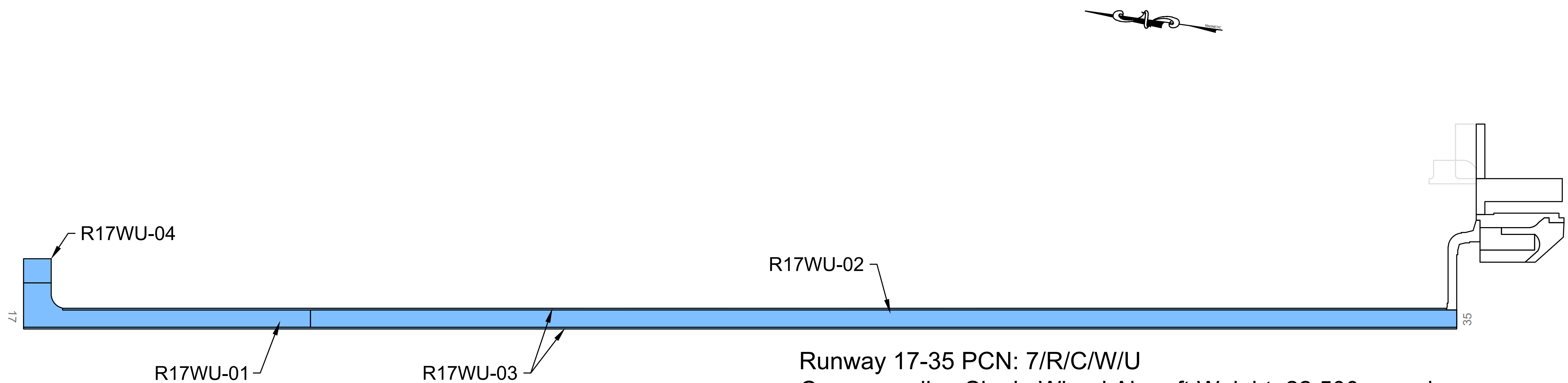
Appendix A

PCN Section Identification Map

FIGURE A-1. PCN Section Identification Map



Runway 17-35 PCN: 7/R/C/W/U
Corresponding Single Wheel Aircraft Weight: 22,500 pounds

LEGEND

RW1533AL-10
(32/F/A/X/T)

BRANCH IDENTIFIER
SECTION IDENTIFIER
PCN VALUE
SECTION BREAK LINE
PCN SECTION

applied pavement TECHNOLOGY
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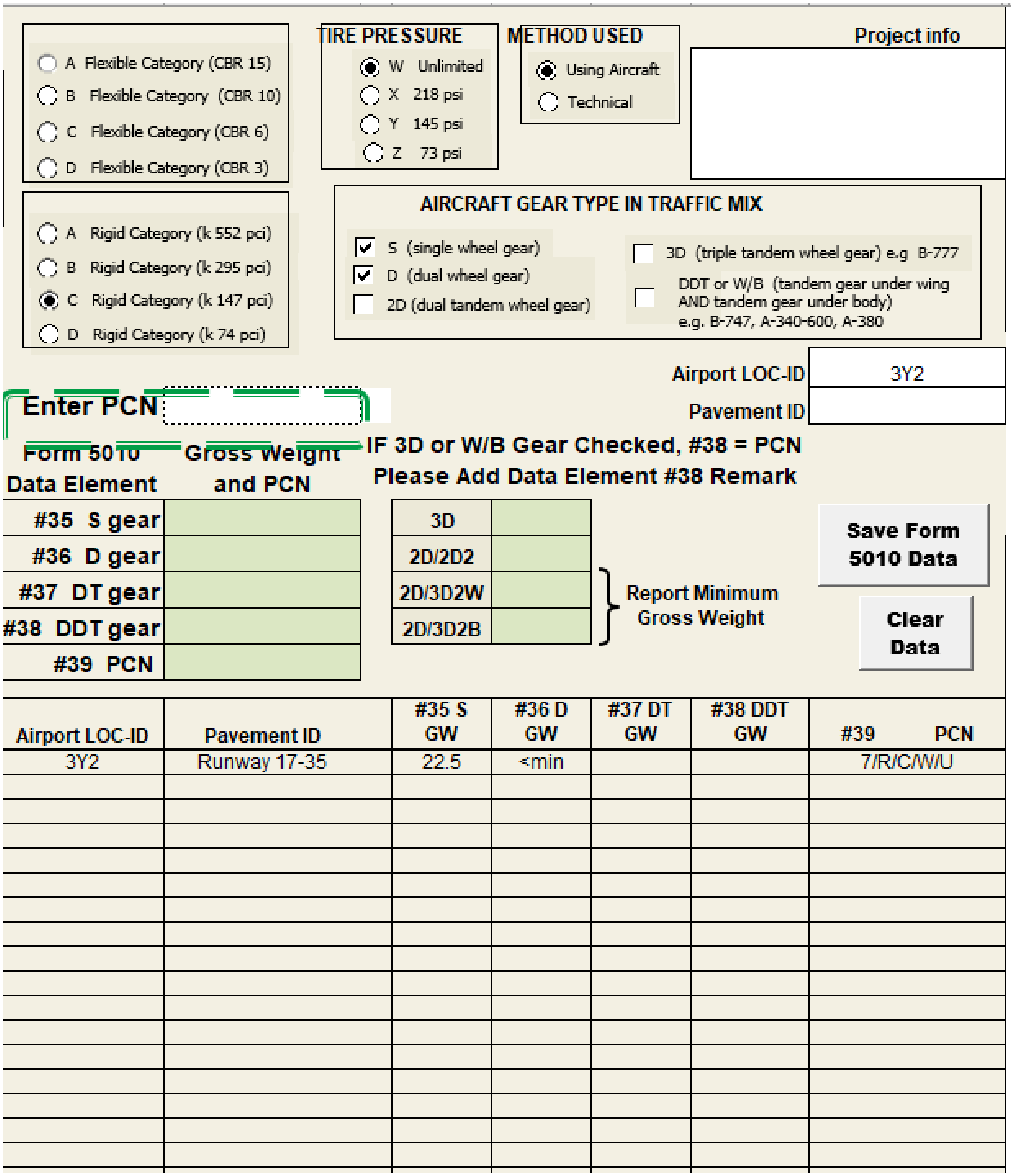
AGENCY: Iowa Department of Transportation Office of Aviation			
LOCATION: West Union Municipal - George L. Scott Airport West Union, Iowa			
PAGE TITLE: PCN Section Identification Map			
PROJECT DATE: SEP. 2017	CREATION DATE: AUG. 2018	PROJECT MANAGER: LJR	JOB NUMBER: 17-020-AM01
DRAWING SCALE: 1"=300'	LAST MODIFIED DATE: AUG. 2018	REVISED BY: MDK	DRAWN BY: KEW
FILENAME: West Union.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)

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

TIRE PRESSURE
W Unlimited (selected)
X 218 psi
Y 145 psi
Z 73 psi

METHOD USED
Using Aircraft (selected)
Technical

Project info

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

Airport LOC-ID: 3Y2
Pavement ID:

Enter PCN

IF 3D or W/B Gear Checked, #38 = PCN
Please Add Data Element #38 Remark

Form 5010 Data Element	Gross Weight and PCN
#35 S gear	
#36 D gear	
#37 DT gear	
#38 DDT gear	
#39 PCN	

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

Report Minimum Gross Weight

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
3Y2	Runway 17-35	22.5	<min			7/R/C/W/U

PREPARED FOR

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