Fort Dodge Regional Airport

Pavement Classification Number Report

USING AIRCRAFT METHOD

PREPARED BY

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FORT DODGE REGIONAL AIRPORT
PAVEMENT CLASSIFICATION NUMBER REPORT

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 select runways in Iowa. However, since PCNs were already published for Runways 6/24 and 12/30 at Fort Dodge Regional Airport APTech did not reanalyze PCNs but rather summarized them in this report.

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 published PCNs presented in this report indicate a Technical Evaluation was completed.

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; 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 Fort Dodge 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
R06FD	01	AAC	6/3/2015	75	0	None
R06FD	02	AAC	6/1/2012	78	22	Alligator Cracking
R12FD	01	APC	6/1/2012	71	0	None
R12FD	02	APC	6/1/2012	69	0	None
R12FD	03	PCC	5/1/2004	73	64	Corner Break, LTD Cracking, Shattered Slab
R12FD	04	PCC	5/1/2004	86	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 6/24 consists of two sections where Section 01 is the majority of the pavement and Section 02 is the area within intersection of Runway 12/30. Both sections were originally constructed with HMA pavement in 1972 and overlaid with HMA pavement in 1991. Section 01 was overlaid again with HMA pavement in 2015 and an HMA overlay on Section 02 was placed in 2012. Both sections have similar PCIs but Section 02 exhibits load-related distresses.

Runway 12/30 contains four sections. Sections 01 and 02 comprise the majority of the runway pavement. Sections 03 and 04 are runway extensions at either end. Sections 01 and 02 were initially constructed with PCC pavement in 1949 and overlaid with HMA pavement in 1972, 1993, and 2012. Sections 03 and 04 were constructed with PCC pavement in 2004. Even though the extension, Section 03, was constructed at same time as Section 04, it has a much lower PCI and is the only section on Runway 12/30 containing load-related distress.

Available work history information for Runways 6/24 and 12/30 is entered in the APMS PAVER database and is also available in the 2019 Individual Airport Pavement Management Report.

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 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 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 2. 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.

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 RESULTS

The aircraft traffic data, subgrade support values (CBR for flexible pavement or effective top-of-base k-value for rigid pavement corresponding to a subgrade category), and pavement evaluation thicknesses are used during Technical Evaluation Method to calculate PCN. For rigid pavements, the PCC flexural strength is also a direct input. As APTech did not complete a Technical Evaluation for the runways at Fort Dodge Regional Airport, and does not have knowledge of the inputs used, these details are not presented in this report.

The published PCNs and the corresponding allowable aircraft weights are summarized in Table 3. The corresponding allowable aircraft weights were determined by APTech using the FAA's COMFAA Support Spreadsheet (as shown in Appendix B), which are approximations and are not specific for any particular aircraft model.

Table 3. Published PCNs 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 6/24	60/F/B/X/T	120,000	232,000	399,000
Runway 12/30	52/F/B/X/T	120,000	203,000	346,000

Table Notes:

1. Single, dual, or dual tandem wheel allowable aircraft weight refers to the aircraft's main gear type. All allowable aircraft weights presented in this table were calculated by APTech using the COMFAA support spreadsheet and correspond with published PCNs.

It must be noted that the allowable aircraft weights published on Airport Data and Information Portal (ADIP) site used to access FAA 5010 data (https://adip.faa.gov/agis/public/#/public) do not correspond with published PCNs. The allowable aircraft weights APTech determined to correspond with the published PCNs using the FAA's COMFAA Support Spreadsheet are higher than the published weights. While APTech was not provided the original documentation on how these PCNs and allowable weights were calculated, a summary of published data for reference is listed herein:

- Runway 6/24 has PCN of 60/F/B/X/T with allowable aircraft weights of 65,000 pounds for single wheel, 110,000 pounds for dual wheel, and 165,000 pounds for dual tandem wheel.
- Runway 12/30 has PCN of 52/F/B/X/T with allowable aircraft weights of 36,000 pounds for single wheel and 58,000 pounds for dual wheel.

Load-related distresses were observed during the 2019 PCI inspection on Runways 6/24 and 12/30, which indicates that some aircraft may be overloading the pavement. Therefore, 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, and is 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 summarizes the published PCNs. The PCN published for Runway 6/24 is 60/F/B/X/T and for Runway 12/30 is 52/F/B/X/T. Load-related distresses were observed during the 2019 PCI inspection on both runways, 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.

REFERENCES

AirNav, LLC. 2018. "Airport Information." www.airnav.com.

ASTM International. 2018. "Standard Test Method for Airport Pavement Condition Index Surveys." ASTM Designation D5340-12(2018). *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.

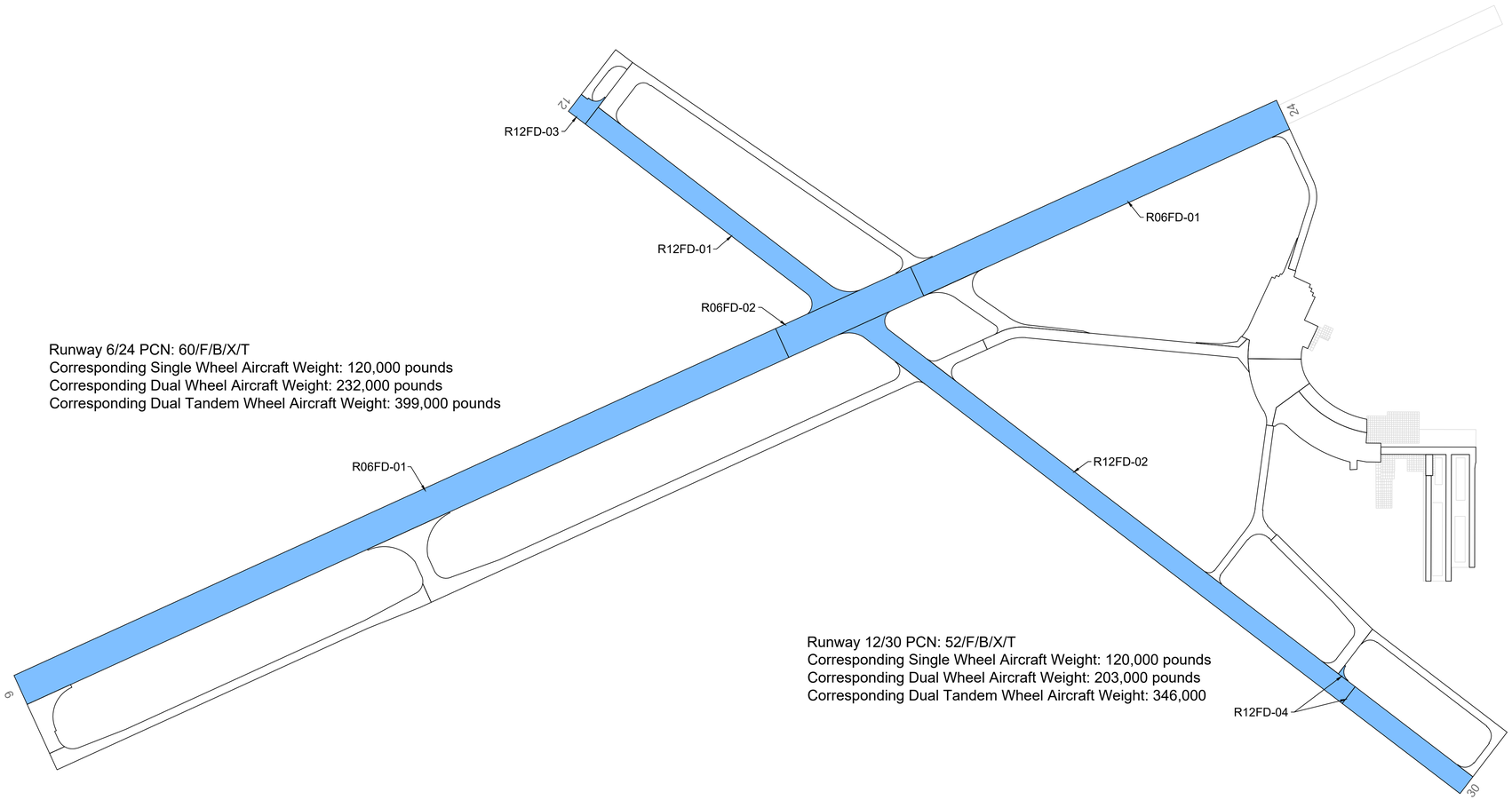
International Civil Aviation Organization (ICAO). 1983. *Aerodrome Design Manual: Pavements*. ICAO 9157-AN/901 Part 3, Second Edition. International Civil Aviation Organization, Montreal, Quebec, Canada.

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.



Runway 6/24 PCN: 60/F/B/X/T
Corresponding Single Wheel Aircraft Weight: 120,000 pounds
Corresponding Dual Wheel Aircraft Weight: 232,000 pounds
Corresponding Dual Tandem Wheel Aircraft Weight: 399,000 pounds

Runway 12/30 PCN: 52/F/B/X/T
Corresponding Single Wheel Aircraft Weight: 120,000 pounds
Corresponding Dual Wheel Aircraft Weight: 203,000 pounds
Corresponding Dual Tandem Wheel Aircraft Weight: 346,000

Disclaimer

PCNs presented on this map are published and available on FAA 5010 form. These PCNs were not calculated by Applied Pavement Technology, Inc (APTech), and are presented here as a reference only.

The allowable aircraft weights shown on this map were calculated by APTech based on the published PCNs. Please note that the published allowable aircrafts weights not calculated by APTech are much lower than those calculated based on the published PCNs.

LEGEND

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

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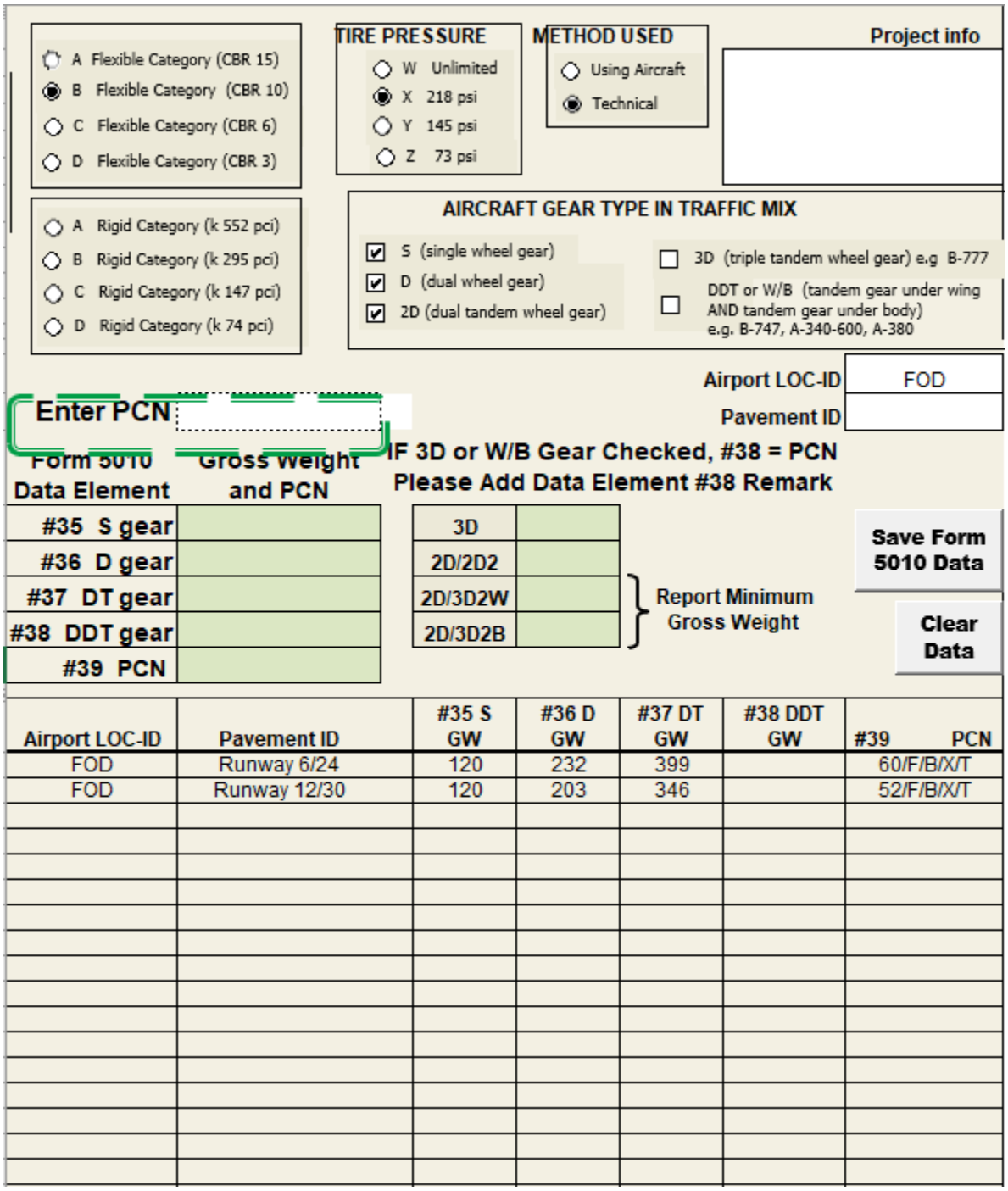
APPENDIX B

FAA FORM 5010 DATA ELEMENTS

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



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