Mason City Municipal Airport

Pavement Classification Number Report

TECHNICAL EVALUATION METHOD

PREPARED BY

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applied pavement TECHNOLOGY

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TABLE OF CONTENTS

LIST OF FIGURES

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 pavements at Mason City Municipal Airport and other airports included in the 2018 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 Mason City 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.

Critical inputs for determining PCNs using a technical approach include pavement cross section, subgrade strength, and aircraft traffic. The Iowa DOT, through collaboration with the FAA, provided design records containing pavement cross section and subgrade data. Where recent design information was available, traffic data associated with the pavement design were also provided. In cases where this information was not directly available, APTech compiled a representative traffic mix for use in the PCN analysis through a review of publicly available data and input from Airport Managers.

APTech used the collected information to determine the PCNs for each included pavement section in accordance with FAA Advisory Circular 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength—PCN*, and supporting COMFAA 3.0 software. Note that PCNs are only intended as a method to report pavement strength for pavements designed for airplane loads of 12,500 pounds or greater. The pavement sectioning is consistent with the nomenclature 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 the pavement that was analyzed at Mason City 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; required 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, *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 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 Mason City Municipal Airport are summarized in Table 1.

Table 1. PCI results.

Branch[1]	Section[1]	Surface Type[2]	Last Construction Date	2018 PCI	Deduct due to Load-Related Distress, %	Load-Related Distress Observed[3]
R12MC	10	AAC	5/3/2006	60	0	None
R12MC	20	AAC	5/3/2006	61	0	None
R12MC	30	AC	6/3/2005	60	0	None
R12MC	40	AC	6/3/2005	67	0	None
R18MC	10	AAC	6/4/2005	64	14	Rutting
R18MC	20	AAC	6/4/2005	64	0	None
R18MC	30	AAC	6/2/2005	64	0	None
R18MC	40	AAC	6/2/2005	61	0	None
R18MC	50	AAC	6/2/2005	60	0	None
R18MC	60	AAC	6/2/2005	60	0	None

[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.

All sections of both runways were rehabilitated between 2005 and 2006 with HMA pavement and have similar PCIs. Only Runway 18/36 Section 10 is exhibiting load-related distress.

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 (i.e., rigid or flexible) and subgrade strength category (i.e., A, B, C, or D, as defined later). Pavements with a PCC layer are generally considered rigid, including those with an HMA overlay; HMA pavements (without underlying PCC layers) are considered flexible. 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 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 2. 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
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

[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 in terms of allowable load for unrestricted operations based on aircraft departures (frequency and weight) and pavement layer properties. The determined PCN is specific for the given conditions and should be recalculated if the aircraft types or volumes change significantly. 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 (as shown in Tables 5 and 6), then the PCN should be recalculated using the operating weights. That said, aircraft would need to be restricted to these analyzed weights to avoid the potential for damaging the pavement.

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 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 ANALYSIS INPUTS

The analysis approach using the FAA's COMFAA software uses the same methodology as the FAA's conventional design procedure outlined in FAA Advisory Circular 150/5320-6D, *Airport Pavement Design and Evaluation*. It incorporates the CBR design procedure for flexible pavements, which determines the required thickness of pavement layers to protect the underlying layers from rutting. For rigid pavements, the design procedure is based on the Westergaard solution for a loaded elastic plate on a Winkler foundation to limit cracking in the PCC pavement.

The aircraft data, subgrade support values (CBR for flexible pavement or effective top-of-base k-value for rigid pavement), and pavement evaluation thicknesses are used directly in COMFAA. For rigid pavements, the PCC flexural strength is also a direct input. Using these inputs, COMFAA iteratively adjusts the critical aircraft weight until the required pavement thickness determined using the software matches the existing pavement cross section. This process is repeated within COMFAA such that each aircraft in the mix is analyzed as the critical aircraft. This calculation produces a PCN associated with each analyzed aircraft; in general, the highest PCN associated with the "regularly using" aircraft is selected to represent the section.

Pavement and Subgrade Layer Properties

Runway 12/30 Sections 10 and 20 were initially constructed in 1944 with HMA pavement and overlaid with HMA pavement in 1968 and 2006. Sections 30 and 40 were reconstructed with HMA pavement in 2005.

Runway 18/36 Sections 10 and 20 were also initially constructed with HMA pavement in 1944. The runway was overlaid and extended (as Sections 30, 40, 50, and 60) with HMA pavement in 1968 and then overlaid again with HMA pavement in 2005.

Pavement cross section information (material types and thicknesses) for Runway 12/30 and Runway 18/36 was obtained from 1974 FAA Form pavement strength survey documents and from 2005 design plans and coring summary.

Foth Infrastructure and Environment, LLC (Foth) recently completed a PCN analysis for the runways at this airport. The resulting PCN was 45/F/C/X/T for Runway 12/30 and 58/F/C/X/T for Runway 18/36. The detailed inputs from that calculation were not available to APTech. Design subgrade strengths from other documented work at this airport varied dramatically and a CBR of 6 was assumed for both runways based on the subgrade category identified from the previously determined PCN.

Detailed work history information for each pavement section is entered in the APMS PAVER database. A summary of the relevant layer thickness information for the PCN analysis is presented in Table 3.

Table 3. Pavement cross section information.

Branch[1]	Section[1]	Construction Date	Layer Thickness, in	Material Type
R12MC	10	5/3/2006	4[2]	HMA (P-401)
R12MC	10	6/1/1968	3	HMA (P-401)
R12MC	10	6/3/1944	3	HMA (P-401)
R12MC	10	6/2/1944	8	Aggregate (P-208)
R12MC	20	5/3/2006	4[2]	HMA (P-401)
R12MC	20	6/1/1968	3	HMA (P-401)
R12MC	20	6/3/1944	3	HMA (P-401)
R12MC	20	6/2/1944	8	Aggregate (P-208)
R12MC	30	6/3/2005	6	HMA (P-401)
R12MC	30	6/2/2005	8	Aggregate (P-208)
R12MC	30	6/1/2005	24	Aggregate (P-154)
R12MC	40	6/3/2005	6	HMA (P-401)
R12MC	40	6/2/2005	8	Aggregate (P-208)
R12MC	40	6/1/2005	24	Aggregate (P-154)
R18MC	10	6/3/2005	6[2]	HMA (P-401)
R18MC	10	6/1/1968	3	HMA (P-401)
R18MC	10	6/3/1944	3	HMA (P-401)
R18MC	10	6/2/1944	8	Aggregate (P-208)
R18MC	20	6/3/2005	6[2]	HMA (P-401)
R18MC	20	6/1/1968	3	HMA (P-401)
R18MC	20	6/3/1944	3	HMA (P-401)
R18MC	20	6/2/1944	8	Aggregate (P-208)
R18MC	30	6/2/2005	6[2]	HMA (P-401)
R18MC	30	6/3/1968	5	HMA (P-401)
R18MC	30	6/2/1968	4.5	HMA (P-201)
R18MC	30	6/1/1968	6	Aggregate (P-209)
R18MC	40	6/2/2005	6[2]	HMA (P-401)
R18MC	40	6/3/1968	5	HMA (P-401)
R18MC	40	6/2/1968	4.5	HMA (P-201)
R18MC	40	6/1/1968	6	Aggregate (P-209)
R18MC	50	6/2/2005	6[2]	HMA (P-401)
R18MC	50	6/4/1968	4	HMA (P-401)
R18MC	50	6/3/1968	6	HMA (P-201)
R18MC	60	6/2/2005	6[2]	HMA (P-401)
R18MC	60	6/4/1968	4	HMA (P-401)
R18MC	60	6/3/1968	6	HMA (P-201)

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

Table 3. Pavement cross section information (continued).

[2]Per 2005 cores, the final HMA thickness for Runway 12/30 Section 10 is 10.5 inches and for Section 20 is 10.7 inches. The total HMA thickness for Runway 18/36 Sections 10 and 20 is 14.1 inches and for Sections 30, 40, 50, and 60 is 14 inches. The HMA overlay thicknesses reported in this table may not reflect milling. Core thicknesses were used for analysis.

The pavement evaluation thickness used for calculating PCNs is determined differently for flexible and rigid pavements. Furthermore, the subgrade strength used for rigid pavement PCN analysis is also determined differently than for flexible pavement. These inputs are listed in Table 4 for each analyzed pavement section; a brief explanation on how these inputs are determined is described in the following paragraphs.

Table 4. Pavement evaluation thickness and subgrade strength for COMFAA analysis.

Branch[1]	Section[1]	Evaluation Thickness, in	Pavement Type	Subgrade CBR, %	Subgrade Category
R12MC	10	25.8	F	6	C
R12MC	20	25.8	F	6	C
R12MC	30	39.2	F	6	C
R12MC	40	39.2	F	6	C
R18MC	10	33.4	F	6	C
R18MC	20	33.4	F	6	C
R18MC	30	30.4	F	6	C
R18MC	40	30.4	F	6	C
R18MC	50	22.0	F	6	C
R18MC	60	22.0	F	6	C

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

For flexible pavement, the evaluation thickness used for the PCN calculation is based on converting the existing pavement layers to a reference FAA cross section using FAA-recommended layer equivalency factors, as defined in FAA Advisory Circular 150/5335-5C. Because there are no aircraft in the traffic mix with four or more wheels on a main gear (i.e., analyzed aircraft are limited to S or D gear types), the following standard FAA cross section is used: 3-inch HMA layer (P-401) on a 6-inch high-quality granular base layer (P-209 or similar). The FAA's COMFAA Support Spreadsheet was used to compute the evaluation thickness, which is a direct input in the PCN analysis. The subgrade strength in terms of a CBR is also a direct input into the PCN calculation for flexible pavements.

For rigid pavements (which were not analyzed at this airport but were presented for completeness), the thickness of the PCC layer is used as the evaluation thickness. In addition to the PCC layer thickness, the PCC flexural strength is also a direct input for PCN analysis of rigid pavement. Base layers are accounted for by converting to a top-of-base k-value (i.e., adjusting the support conditions) rather than contributing to the overall evaluation thickness. The FAA's COMFAA Support Spreadsheet is used to determine the top-of-base k-value used in the PCN analysis.

For composite pavements analyzed as rigid structures (which were not analyzed at this airport but were presented for completeness), the thickness of the HMA surface is converted to an equivalent PCC thickness and combined with the PCC thickness to compute the evaluation thickness (where 2.5 inches of HMA is considered to be equivalent to 1 inch of PCC, following FAA guidance).

Traffic

The traffic data provide a representation of the aircraft using each facility and are an estimate of the 20-year average annual departures. Only departures are used for the analysis following the FAA's procedure because they generally have heavier loads due to fuel weight. In cases where actual operating weights of aircraft were not specified, maximum takeoff weights (MTOW) are used, and this process incorporates some conservatism into the analysis. The entire aircraft traffic mix associated with each facility is entered directly into COMFAA. Because PCN calculations are dependent on the aircraft using a facility, PCNs should be recalculated if the aircraft mix or volume changes significantly.

As previously stated, APTech compiled a representative traffic mix for use in the PCN analysis based on available information. The traffic data for Runways 12/30 and 18/36 were determined through a review of publicly available data and supplemental input from the Airport Operations Supervisor. The traffic details provided by airport personnel were fairly detailed, although they may differ from the traffic used during the PCN calculation recently completed by Foth. The determined traffic information is presented in Table 5 along with the corresponding ACNs (as determined using COMFAA) for the pavement types and subgrade strength categories associated with Mason City Municipal Airport.

To account for back-taxiing needs, the FAA's PCN analysis allows the number of aircraft passes per traffic cycle to be increased. A pass-to-traffic cycle (P/TC) ratio of one is used in most cases with a standard runway and parallel taxiway configuration. A P/TC ratio of two is used for runways with a mid-field taxiway configuration, which would require aircraft to back-taxi prior to takeoff. A P/TC ratio of one was used for Runway 12/30 based on the runway having a parallel taxiway and for Runway 18/36 based on taxiway access to the approach ends of Runway 18 and 36.

When the pavement capacity greatly exceeds the load applied by the aircraft in the analyzed traffic mix, analysis inputs are adjusted to attain a cumulative damage factor (CDF) of 0.15, per guidance in FAA Advisory Circular 150/5335-5C. Additionally, PCNs are based on aircraft that regularly use a facility, where FAA Advisory Circular 150/5335-5C defines aircraft that regularly use the pavement as those with more than 1,000 coverages over the 20-year analysis period. As such, the reported PCNs are based on at least 1,000 coverages of the determining aircraft.

A coverage represents a full-load application on a point in the pavement to account for aircraft/pilot wander. The number of passes required to statistically "cover" the intended wheel path on the pavement is expressed by pass-to-coverage (P/C) ratio (where a pass is a one-time movement of the aircraft over the pavement). The P/C ratio varies by aircraft, where smaller aircraft generally have more wander. Coverages were determined using COMFAA. Appendix A of FAA Advisory Circular 150/5335-5C provides detailed definitions regarding traffic terminology.

Table 5. Traffic data.

Aircraft	Weight, lbs	Gear Type[1]	Tire Pressure, psi	Annual Departures for Runway 12/30	Annual Departures for Runway 18/36	ACN: Rigid Pavement, Subgrade Category C
Piper PA-24	3,200	S	50	8,309	3,561	1
Eclipse 500	6,000	S	62	2	1	2
Piper Navajo PA-31	6,536	S	66	3,011	1,320	2
Citation 510	8,645	S	75	3	1	3
Citation 501	11,850	S	130	31	13	5
Cessna Citation CJ4	17,110	S	130	123	53	7
Cessna Excel/XLS	20,200	S	214	5	2	9
Learjet 31	15,500	D	171	4	2	6
Learjet 45	21,500	D	201	39	17	6
Hawker 800	27,520	D	135	16	7	8
Challenger 300	38,850	D	208	18	8	12
Challenger CL-604	48,200	D	145	15	6	14
Gulfstream G-V	91,000	D	188	6	2	29
C-130	155,000	2S	105	1	1	32
B737-800	174,400	D	205	3[2]	3[2]	50

[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*).

[2]Departure volumes were increased from the amount shown to correspond to at least 1,000 coverages in order to report a PCN that accounts for regular use of this aircraft.

PCN RESULTS

The PCNs associated with each included pavement section of Runways 12/30 and 18/36 are presented in Table 6 along with 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). PCNs 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 6. PCN results and corresponding allowable aircraft weights.

Branch[1]	Section[1]	PCN	Single Wheel[2] Allowable Aircraft Weight, lbs	Dual Wheel[2] Allowable Aircraft Weight, lbs
R12MC	10[3]	48/F/C/X/T	120,000	171,000
R12MC	20[3]	48/F/C/X/T	120,000	171,000
R12MC	30	66/F/C/X/T	120,000	232,000
R12MC	40	66/F/C/X/T	120,000	232,000
R18MC	10	66/F/C/X/T	120,000	232,000
R18MC	20	66/F/C/X/T	120,000	232,000
R18MC	30	65/F/C/X/T	120,000	228,000
R18MC	40	65/F/C/X/T	120,000	228,000
R18MC	50[3]	34/F/C/X/T	88,000	119,000
R18MC	60[3]	34/F/C/X/T	88,000	119,000

[1]See Figure A-1 located in Appendix A for the location of the branch and section.
[2]Refers to the aircraft's main gear type.
[3]This section is not structurally adequate to handle frequent operations of the analyzed B737 aircraft.

The recommended PCN for Runway 12/30 is 48/F/C/X/T based on the structural capacity of the controlling pavement structure, Sections 10 and 20. The ACN of a fully loaded Boeing 737 slightly exceeds this PCN if frequent operations are assumed, as illustrated in Figure 1. However, operations would be permitted following general overload guidance and the detailed analysis indicates that the analyzed limited annual departures of this aircraft listed in Table 5 do not overload this runway.

The recommended PCN for Runway 18/36 is 34/F/C/X/T based on the structural capacity of the controlling pavement structure, Sections 50 and 60. This portion of Runway 18/36 is thinner than other sections of this runway and that of the other runway. The PCN analysis indicates that the north (18) end of this runway is not structurally adequate for frequent operations of the Boeing 737. However, the detailed PCN analysis indicates that the limited number of annual departures of the Boeing 737 aircraft listed in Table 5 does not overload this runway. Also, the PCNs determined for the remainder of this runway exceed that of the corresponding ACNs of the analyzed traffic. Figure 2 illustrates the extent to which the ACNs of the Boeing 737 exceeds the calculated PCN.

The PCN APTech determined for Runway 12/30 is in line with what was previously determined by Foth (45/F/C/X/T). However, the PCN presented herein based on the structural capacity of the north end of Runway 18/36 is lower than the PCN determined by Foth (58/F/C/X/T). The previous calculation may have been based on the overall average runway thickness rather than limitation of any individual pavement sections; however, the actual differences in calculations cannot be stated with certainty.

Figure 1. ACN–PCN comparison for Runway 12/30.

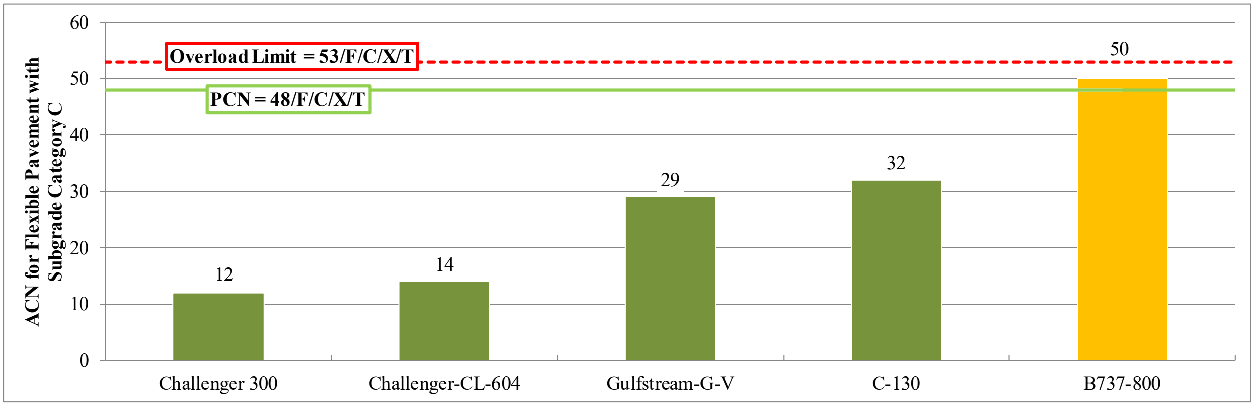
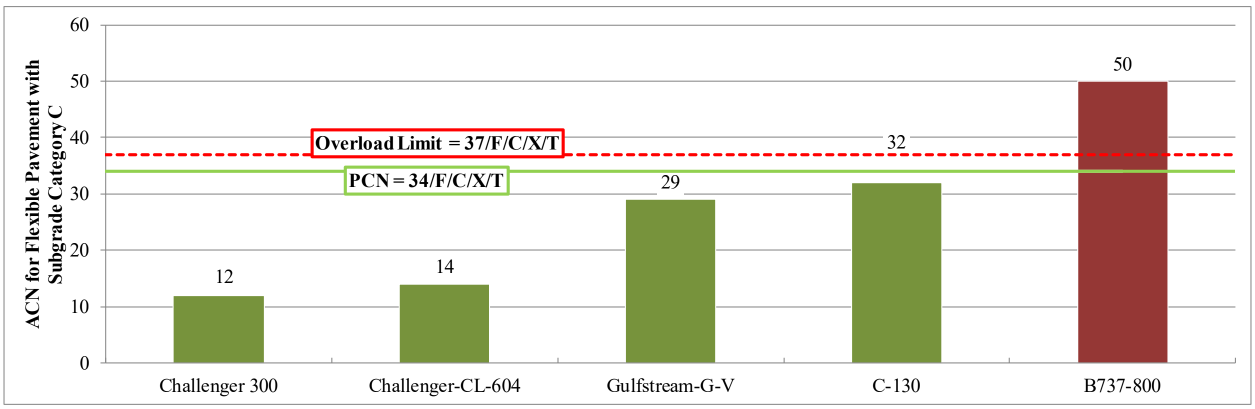


Figure 2. ACN–PCN comparison for Runway 18/36.



As previously indicated, in order to avoid over-reporting the pavement's load-bearing capacity, the PCN calculation procedure outlined in FAA Advisory Circular 150/5335-5C limits the PCN based on the ACNs associated with the analyzed aircraft. Therefore, if the traffic mix changes, the PCN should be recalculated.

The discussion presented herein is based on a straightforward comparison between ACNs (for the aircraft at their analyzed weights) and PCNs for each pavement section. 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. 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.

In general, pavement overloads are expected to decrease pavement life but do not often cause immediate or catastrophic failures unless they are excessive. While the FAA's pavement structural capacity approach is conservative, where overload operations are conducted, Mason City Municipal Airport should be aware of the effect and risks of operating these aircraft based on the PCN analysis results determined using the Technical Evaluation Method.

SUMMARY

This report presents an overview of the ACN–PCN procedure, summarizes the inputs used for the calculation (including the subgrade strength, PCC flexural strength where applicable, pavement evaluation thickness, and traffic), and documents the results of the PCN analysis. Additionally, 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.

The PCNs presented within this document are calculated using the FAA's Technical Evaluation Method for determining PCNs, as described in FAA Advisory Circular 150/5335-5C. The PCNs recommended for publication are 48/F/C/X/T for Runway 12/30 and 34/F/C/X/T for Runway 18/36. The detailed analysis of both runways indicates they are structurally adequate for the limited operations of the analyzed aircraft but that frequent operations of the analyzed Boeing 737 would overload these facilities. The ACN of the Boeing 737 exceeds the determined PCNs but only marginally for Runway 12/30.

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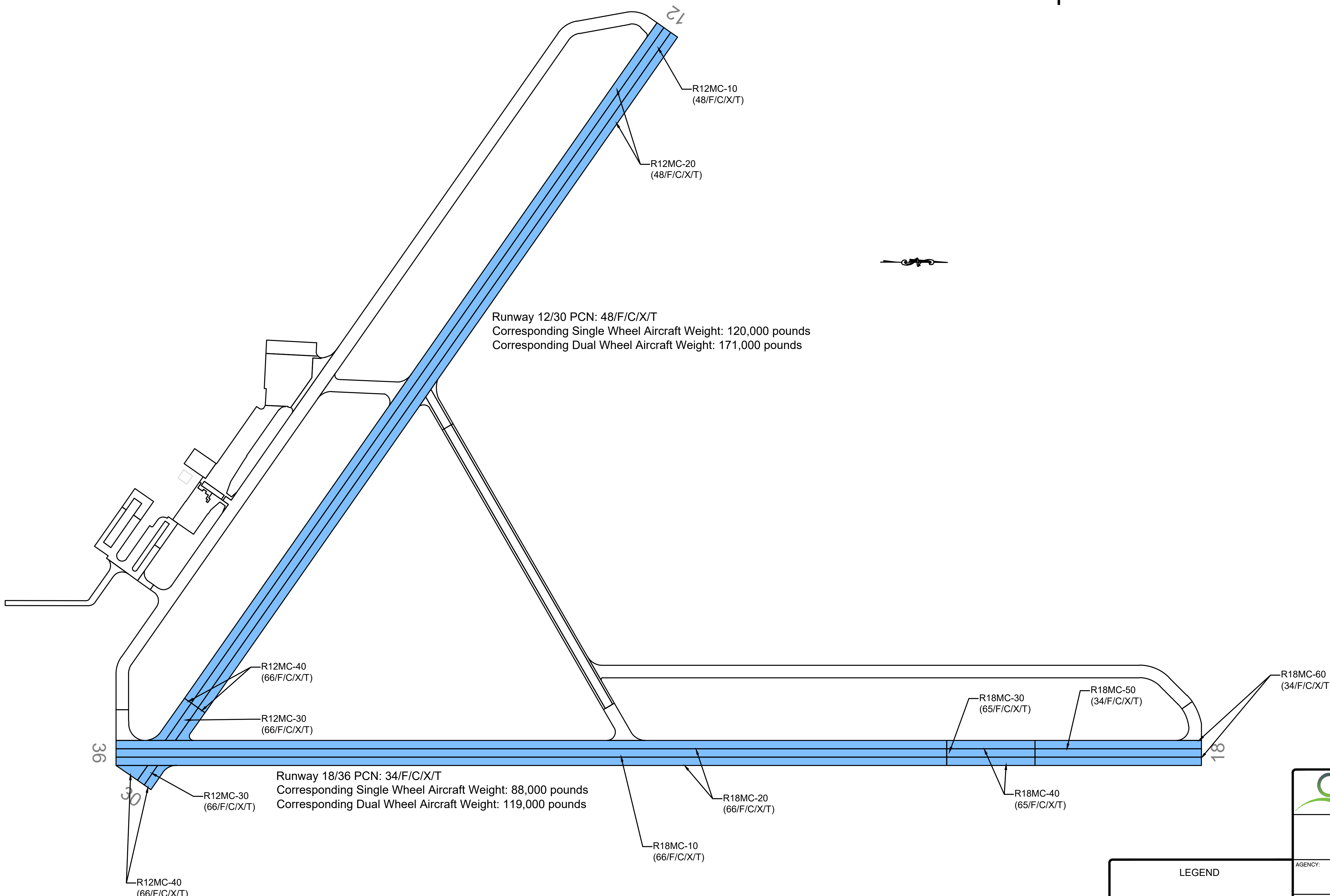
APPENDIX A

PCN SECTION IDENTIFICATION MAP

FIGURE A-1. PCN Section Identification Map



LEGEND

R02AT-10 — BRANCH IDENTIFIER / SECTION IDENTIFIER

(32/F/A/X/T) — PCN VALUE

SECTION BREAK LINE

PCN SECTION

applied pavement TECHNOLOGY
115 W. Main Street, Suite 400
Urbana, IL 61801
Tel: (217) 398-3977
Fax: (217) 398-4027

Robinson Engineering Company
Consulting Engineers
322 1st Street East
Independence, IA 50644
Tel: (319) 334-7211

AGENCY: Iowa Department of Transportation Office of Aviation

LOCATION: Mason City Municipal Airport, Mason City, Iowa

PAGE TITLE: PCN Section Identification Map

PROJECT DATE: OCT. 2018	CREATION DATE: JUL. 2019	PROJECT MANAGER: LJR	JOB NUMBER: 17-020-AM02
DRAWING SCALE: 1"=600'	LAST MODIFIED DATE: NOV. 2019	REVISED BY: DSP	DRAWN BY: KEW
FILENAME: Mason 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)

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

TIRE PRESSURE

- ( ) W Unlimited
- (●) X 218 psi
- ( ) Y 145 psi
- ( ) Z 73 psi

METHOD USED

- ( ) Using Aircraft
- (●) Technical

Project info

AIRCRAFT GEAR TYPE IN TRAFFIC MIX

- [x] S (single wheel gear)
- [x] D (dual wheel gear)
- [ ] 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 MCW

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
MCW	RW12MC-10	120	171			48/F/C/X/T
MCW	RW12MC-20	120	171			48/F/C/X/T
MCW	RW12MC-30	120	232			66/F/C/X/T
MCW	RW12MC-40	120	232			66/F/C/X/T
MCW	RW18MC-10	120	232			66/F/C/X/T
MCW	RW18MC-20	120	232			66/F/C/X/T
MCW	RW18MC-30	120	228			65/F/C/X/T
MCW	RW18MC-40	120	228			65/F/C/X/T
MCW	RW18MC-50	88	119			34/F/C/X/T
MCW	RW18MC-60	88	119			34/F/C/X/T

PREPARED FOR

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NOVEMBER 2019