



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

/INCLUDES CHANGE 1/

Subject: STANDARDIZED METHOD OF  
REPORTING AIRPORT PAVEMENT  
STRENGTH - PCN

Date: 6/15/83  
Initiated by: AAS-200

AC No: 150/5335- 5  
Change:

1. **PURPOSE.** This advisory circular (AC) provides guidance for using the standardized International Civil Aviation Organization (ICAO) method to report airport pavement strength. The standardized method is known as the ACN/PCN method.
2. **FOCUS.** Member countries of ICAO are required to report pavement strength information for a variety of purposes. A new method has been developed which will be used as an international standard and will greatly facilitate the exchange of information. This AC provides specific guidance on how to report airport pavement strength using the standardized method.
3. **RELATED READING MATERIAL.** The publications listed in appendix 1 provide further information on the development and use of the ACN/PCN method.

LEONARD E. MUDD  
Director, Office of Airport Standards

## CONTENTS

CHAPTER 1. INTRODUCTION

<u>Paragraph.</u>		<u>Page</u>
1.	Background . . . . .	1
2.	Application . . . . .	1
3.	Development of a Standardized Method . . . . .	1
4.	Determination of the ACN . . . . .	2
5.	Determination of the PCN Value . . . . .	2
6.	Limitations . . . . .	2
7.	Reporting the PCN . . . . .	2

CHAPTER 2. PCN DETERMINATION

8.	Format . . . . .	5
9.	PCN Numerical Value . . . . .	5
10.	Pavement Type . . . . .	5
11.	Subgrade Strength . . . . .	5
12.	Tire Pressure . . . . .	6
13.	Evaluation Methods . . . . .	6
14.	Computation of PCN Numerical Values . . . . .	7
15.	Examples . . . . .	15
16.	Light Load Pavements . . . . .	16
17.	Pavements of Less Than 12,500 pounds (5 700 kg) Bearing Strength . . . . .	20
18.	Summary . . . . .	20
Appendix 1.	Related Reading Material (1 page) . . . . .	1
Appendix 2.	Selected ACN Values (5 pages) . . . . .	1
Table 1	ACN's For Several Aircraft Types on Rigid and Flexible Pavements	

Figure

2-1.	PCN Numerical Values for Single-Wheel Load Rating--Heavy Load Flexible Pavement . . . . .	8
2-2.	PCN Numerical Values for Single-Wheel Load Rating--Heavy Load Rigid Pavement . . . . .	9
2-3.	PCN Numerical Values for Dual-Wheel Load Rating--Heavy Load Flexible Pavement . . . . .	11
2-4.	PCN Numerical Values for Dual-Wheel Load Rating--Heavy Load Rigid Pavement . . . . .	12
2-5.	PCN Numerical Values for Dual-Wheel Load Rating--Heavy Load Flexible Pavement . . . . .	13

2-6. PCN Numerical Values for Dual-Tandem Load Rating--Heavy Load Rigid Pavement . . . . .	14
2-7. PCN Numerical Value for Various Load Ratings--Example Plot . . . . .	17
2-8. PCN Numerical Values for Gross Weight Rating--Light Load Flexible Pavement . . . . .	18
2-9. PCN Numerical Values for Gross Weight Rating--Light Load Rigid Pavement . . . . .	19

#### Tables

2-1. Subgrade Strength Categories . . . . .	5
2-2. Subgrade Strength Categories Based on Soil Classification . . . . .	6
2-3. Allowable Tire Pressure Categories . . . . .	6
2-4. Single Wheel Assembly . . . . .	7
2-5. Dual Wheel Assembly . . . . .	10
2-6. Dual Tandem Assembly . . . . .	10
2-7. PCN--Five Part Code . . . . .	20

## CHAPTER 1. INTRODUCTION

1. BACKGROUND. Through treaty agreements, the United States is a member of the International Civil Aviation Organization (ICAO) and is bound to comply with the requirements of ICAO to the maximum extent practical (see FAA Order 2100.13, FAA Rulemaking Policies, Chapter 11). Annex 14 - Aerodromes to the Convention of International Civil Aviation requires that each member country publish information on the strengths of all public airport pavements in its own Aeronautical Information Publication (AIP). In the past, the Annex recognized four methods of reporting airport pavement strength. Any one of the four methods was considered equal and acceptable, but mixed use made transfer of information between different methods difficult at best. As a result, the reporting of pavement strength information was inadequate.

2. APPLICATION. The use of the standardized method of reporting pavement strength applies only to pavements with bearing strengths of 12,500 pounds (5 700 kg) or greater. The method of reporting pavement strength for pavements of less than 12,500 pounds (5 700 kg) bearing strength remains unchanged.

3. DEVELOPMENT OF A STANDARDIZED METHOD. In 1977 the ICAO established a Study Group to develop a single international method of reporting pavement strengths. The study group was composed of experts nominated by six countries and three international organizations: Australia, Canada, France, Netherlands, United Kingdom, and United States; Airport Associations Coordinating Council, International Air Transport Association, and International Coordinating Council of Aircraft Industries Association. The study group developed the Aircraft Classification Number - Pavement Classification Number (ACN-PCN) method. Using this method, it is possible to express the effect of individual aircraft on different pavements by a single unique number which varies according to pavement type and subgrade strength, without specifying a particular pavement thickness. This number is the Aircraft Classification Number (ACN). Conversely, the load carrying capacity of a pavement can be expressed by a single unique number, without specifying a particular aircraft. This number is the Pavement Classification Number (PCN). The ACN and PCN values are defined thusly:

ACN - A number which expresses the relative structural effect of an aircraft on different pavement types for specified standard subgrade strengths in terms of a standard single wheel load.

PCN - A number which expresses the relative load carrying capacity of a pavement in terms of a standard single wheel load.

The system is structured so that a pavement with a particular PCN value can support, without weight restrictions, an aircraft which has an ACN value equal to or less than the pavement's PCN value. This is possible because ACN and PCN values are computed using the same technical basis.

4. DETERMINATION OF THE ACN. The computation of ACN values will rarely, if ever, be required by anyone other than aircraft manufacturers. The description of the ACN is presented here mainly for informational purposes. The ACN has been developed for two types of pavement--rigid or flexible--and for four levels of subgrade strengths.

a. For rigid pavements, the aircraft landing gear flotation requirements are determined by the Westergaard solution for a loaded elastic plate on a Winkler foundation (interior load case), assuming a concrete working stress of 399 psi (2.75 MPa). Four different subgrade strengths are considered: high--554 pci (150 MN/m<sup>3</sup>), medium--296 pci (80 MN/m<sup>3</sup>), low--148 pci (40 MN/m<sup>3</sup>), and ultra low--74 pci (20 MN/m<sup>3</sup>). Using these parameters, a standard single wheel load at a tire pressure of 181 psi (1.25 MPa) is computed for each subgrade strength. The standard single wheel load is expressed in kilograms and divided by 500 to obtain the ACN. Division by 500 is a rounding off process to make the numbers smaller and more manageable. (See ICAO Bulletin, Vol. 35, No. 1, 1980.)

b. For flexible pavements, aircraft landing gear flotation requirements are determined by the California Bearing Ratio (CBR) method. As with the rigid pavement, four different subgrade strengths are considered: high (CBR=15), medium (CBR=10), low (CBR=6) and ultra low (CBR=3). A standard single wheel load at a tire pressure of 181 psi (1.25 MPa) is computed for each of these subgrade strengths. The standard single wheel load is expressed in kilograms and divided by 500 to obtain the ACN. (See ICAO Bulletin, Vol. 35, No. 1, 1980.)

5. DETERMINATION OF THE PCN VALUE. The PCN numerical value for a particular pavement is determined from the allowable load rating, i.e., bearing strength, of the pavement. The allowable load rating can be determined by applying the principles contained in AC 150/5320-6, Airport Pavement Design and Evaluation. In determining the allowable load rating, such factors as frequency of operations and permissible stress levels should be taken into account. Once the allowable load rating is established, the determination of the PCN value is a process of converting that rating to a standard relative value. Curves for converting allowable load ratings to PCN values are presented in the following chapters.

6. LIMITATIONS. The PCN value is for reporting pavement strength only. The PCN value expresses the results of pavement evaluation in relative terms and cannot be used for pavement design or as a substitute for evaluation. Pavement design and evaluation are complex engineering problems which require detailed analyses. They cannot be reduced to a single number.

7. REPORTING THE PCN. The PCN system uses a coded format to maximize the amount of information contained in a minimum number of characters and to facilitate computerization. In addition to the previously discussed PCN numerical value, the PCN code includes: pavement type, subgrade category, allowable tire pressure, and method used to determine the PCN. Therefore, an example of a PCN code is 80/R/B/W/T--with 80 expressing the PCN numerical value, R is for rigid pavement, B for medium strength subgrade, W for high allowable tire pressure, and the T indicates the PCN value was obtained by a technical evaluation. All of the various coded entries are fully explained in chapter 2. Once a PCN value and the coded

6/15/83

AC 150/5335-5

entries are determined, the PCN code should be reported to the regional Federal Aviation Administration (FAA) Airports Division, either by writing the FM or as part of the annual FAA updating of the Airport Master Record, FM Form 5010-1. The PCN code is then forwarded to FAA headquarters and disseminated by the National Flight Data Center through aeronautical publications such as the Airport/Facility Directory and the Aeronautical Information Publication. The published PCN can then be compared with an aircraft's ACN to determine if the aircraft can operate on an airport's runways without weight restriction.

## CHAPTER-Z. PCN DETERMINATION

8. FORMAT. The PCN for any pavement is reported by a code consisting of five elements: PCN Numerical Value, Pavement Type, Subgrade Strength, Tire Pressure, and Evaluation Method. Each element of the code is explained in the following paragraphs.

9. PCN NUMERICAL VALUE. The PCN Numerical Value is a relative indication of the load carrying capacity of a pavement in terms of a standard single wheel load at a tire pressure of 181 psi (1.25 MPa). The PCN Numerical Value should be reported in whole numbers, rounding off any fractional parts to the nearest whole number. For pavements of variable strength, the controlling PCN Numerical Value for the weakest segment of the pavement should be reported as the strength of the pavement. Since the PCN Numerical Value is dependent on other elements in the code, the explanation of its computation comes in paragraph 14 of this chapter.

10. PAVEMENT TYPE. Two pavement types are recognized in the PCN method--rigid (R) or flexible (F).. Composite or unconventional pavement should be coded as either Code R or Code F depending on the method used in computing the PCN. For example, if a runway is composed of rigid pavement with a bituminous overlay, the usual manner of determining the load carrying capacity is to convert the pavement to an equivalent thickness of rigid pavement; this is done even though the runway surface composition is asphalt. Hence in this instance, the pavement type should be reported as R in the PCN code.

11. SUBGRADE STRENGTH. Four subgrade strength categories are used to report subgrade strength for each pavement type. They are defined and coded in tables 2-1 and 2-2.

Table 2-1. SURGRADE STRENGTH CATEGORIES

Category	Rigid Pavement k value Strength Range		Flexible Pavement CBR Strength Range	Code Designation
	lbs/in <sup>3</sup>	MN/m <sup>2</sup>		
High	greater than 400	greater than 120	greater than 13	A
Medium	201-400	61-120	8 - 13	B
Low	100-200	25-60	4 - 8	C
Ultra low	less than 100	less than 25	less than 4	D

Note: Guidance on the assignment of k values and CBR values can be found in AC 150/5320-6.

For convenience, the subgrade strength categories have been related to soils classification. While it is important to have complete and accurate soils strength information, approximations based on soils classification may be used for the purposes of reporting PCN. Both the Unified and FAA soils classifications are shown in table 2-2. Although the FAA method has been phased out, it is shown here so that old records may be used and new soils tests will not have to be conducted merely for PCN purposes.

TABLE 2-2. SUBGRADE STRENGTH CATEGORIES BASED ON SOIL CLASSIFICATION

Category	Code	Soil Classification	
		Unified	FAA
High	A	GW, GP, GM,	Fa, F1, F2
Medium	B	GC, SW, SM, SP	F3, F4, F5
Low	C	SC, ML, CL, OL	F6, F7, F8, F9
Ultra-low	D	OM, CH, MH	F10

Note: See AC 150/5320-6 for further details on soil classification.

12. TIRE PRESSURE. Four different categories are used to report allowable tire pressure in the PCN code. They are defined and coded in table 2-3.

TABLE 2-3. ALLOWABLE TIRE PRESSURE CATEGORIES

Category	Range		Code Designation
	psi	MPa	
High	No limit	No limit	W
Medium	146-217	1.01-1.50	X
LOW	74-145	0.51-1.0	Y
Very Low	0-73	0-0.5	Z

Tire pressure will have little effect on pavements with portland cement concrete surfaces. Portland cement concrete surfaces can usually accommodate high tire pressures. Tire pressures may be restricted on asphaltic concrete depending on the quality of the asphalt mix and climatic conditions. For pavements where tire pressure is restricted, the allowable tire pressure should be reported in accordance with table 2-3.

13. EVALUATION METHODS. Two pavement evaluation methods are recognized in the PCN system. If the evaluation represents the results of a technical study, the evaluation method should be coded T. If the evaluation is based on using aircraft experience, the evaluation method should be coded U. Technical evaluation (T) implies that some form of technical study and computation were involved in the



determination of the PCN. Using aircraft evaluation (U) means the PCN was determined by selecting the highest ACN among the aircraft currently using the facility and not causing pavement distress. No technical input is required for the using aircraft evaluation method. PCN values computed from allowable loads shown on FM Form 5010-1, Airport Master Record, should be considered technical evaluations. Publication of a using aircraft evaluation on the FAA Form 5010-1 is permitted only by mutual agreement between the airport owner and the FAA.

14. COMPUTATION OF PCN NUMERICAL VALUES. Procedures for the computation of PCN numerical values are presented in two different categories--heavy load pavements, intended to support aircraft weighing 30,000 pounds (13 000 kg) or more, and light load pavements, intended to support aircraft weighing between 29,999 pounds (13 000 kg) and 12,500 pounds (5 700 kg). These categories were chosen to be consistent with FM pavement design and evaluation standards.

a. Heavy Load Pavements. The computation of PCN numerical values is designed to require a minimum number of inputs. Charts have been developed which require input for subgrade strength category and allowable gross weight. With these two parameters, a PCN numerical value can be obtained. Charts to compute PCN values for single, dual, and dual-tandem landing gear are shown in figures 2-1 through 2-6. The single, dual, and dual-tandem ratings are for generalized landing gear configurations and do not represent specific aircraft. A conversion for double-dual-tandem landing gear was not prepared because this rating refers to a specific aircraft, the Boeing 747. In the generalized landing gear configurations, certain assumptions are made, i.e., all aircraft are assumed to have 95 percent of the gross weight carried by the main gear assembly and the nose gear assembly is assumed to carry 5 percent of the gross weight of the aircraft. Other assumed characteristics are discussed in the following subparagraphs.

(1) Single Wheel. Table 2-4 shows the characteristics which are assumed for the main landing gear assembly.

TABLE 2-4. SINGLE WHEEL ASSEMBLY

Gross Weight		Tire Pressure	
lbs.	kg	psi	MPa
30,000	13 600	75	0.52
45,000	20 400	90	0.62
60,000	27 200	105	0.73
75,000	34 000	120	0.83

Using the above assumptions, charts that convert single-wheel allowable gross weight to PCN numerical values, for both flexible and rigid pavements, are shown in figures 2-1 and 2-2.