



THE STRENGTH OF AIRPORT PAVEMENTS

1. Introduction

The Aircraft Classification Number – Pavement Classification Number (ACN-PCN) is a standardized method set by the ICAO to report airport runway, taxiway, and apron pavement strength. It is used to assess the operation conditions of an aircraft depending on its weight and on the strength of the pavements.

This information is published in a standardized format following the guidelines provided in the Annex 14 of ICAO Regulations.

2. PCN: Pavement Classification Number

The PCN is a five-part code associated to any section of the airport pavements (runway, taxiways, aprons or ramps) and indicates its mechanical resistance with respect to excessive wear and tear.

Each part of the code is separated by a forward-slash.

- **PCN numerical value:** it indicates the load-carrying capacity of the pavement.
- **First letter:** it indicates the **rigidity** of the pavement
 - R for rigid (most typically concrete)
 - F for flexible (most typically asphalt)
- **Second letter:** it expresses the **strength** of what is underneath the pavement section, known as the **subgrade**
 - A for high
 - B for medium
 - C for low
 - D for ultralow
- **Third letter:** it expresses the **maximum tire pressure** that the pavement can support
 - W: no pressure limit
 - X: 1.5 MPa
 - Y: 1.0 MPa
 - Z: 0.5 MPa
- **Fourth letter:** it describes **how the PCN numerical value was determined**
 - T indicates technical evaluation
 - U indicates usage – a physical testing regime

Example: PCN = 27/F/A/W/T
PCN is normally published on charts.

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3. ACN: Aircraft Classification Number

The ACN is a single unique number that expresses the relative effect of an airplane of a given weight on a pavement structure for a specified standard subgrade strength.

The airplane manufacturer provides the official computation of a reference ACN value. Nevertheless, the computation of the actual ACN requires detailed information on the operational characteristics of the airplane such as maximum centre of gravity, maximum ramp weight, wheel spacing, tire pressure, and other factors.

A typical ACN for a given aircraft is normally provided as follows:

Aircraft type: A320-100	Reference weight	Subgrade class							
		Flexible pavement				Rigid Pavement			
		A	B	C	D	A	B	C	D
Maximum Apron Weight	83400 Kg	45	48	53	59	50	55	57	59
Operating Empty Weight	47000 Kg	23	24	26	30	26	28	29	31

An exhaustive list of the ACN for most of the existing aircraft can be found in IVAO HQ documentation.

The actual ACN of a given aircraft of weight M and corresponding to a pavement with known characteristics can be calculated as follows:

$$ACN_M = ACN_{min} + \frac{(ACN_{max} - ACN_{min}) * (M - M_{min})}{(M_{max} - M_{min})}$$

M_{min} is the Operating Empty Weight

M_{max} is the Maximum Apron Weight

M is the landing Weight

ACN_{min} and ACN_{max} are the ACN corresponding to M_{min} and M_{max} respectively

The calculated ACN is then compared to the PCN of the foreseen airport pavements to assess the feasibility of the aircraft manoeuvre and operations.

4. Practice of ACN/PCN method

4.1. General principle

An aircraft, characterized by its actual operating weight (at pushback, taxi, takeoff and landing), is authorized to operate and manoeuvre on a given airport zone (ramp, apron, taxiway, runway) depending on the comparison between its actual ACN and the published PCN of the concerned pavement.

If $ACN < PCN$ the aircraft can manoeuvre without restrictions.

If $ACN > PCN$ the aircraft can be accepted under specific limitations, concerning for example its maximum weight or the operation frequency

The requirements imposed by the ACN/PCN method are essentially meant to preserve the quality of the airport pavements and improve their lifetime. This is the reason why operation under specific limitations is accepted since it does not affect the safety of aircraft and people.

4.2. Tolerance of acceptance

Nevertheless, whenever the difference between the ACN and the PCN exceeds 10% for flexible pavements or 5% for rigid ones, specific studies are carried out to assess the operation feasibility and associated maintenance over costs.

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4.3. Flowchart of the ACN/PCN method

The ANC/PCN method can be synthesized by the following algorithm that must be used step by step to evaluate the allowable load on the concerned pavement and compare it with the actual aircraft weight.

