

ACR-PCR method for airport pavement applicable from 2024

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1. Introduction

Annex 14 established by the ICAO (International Civil Aviation Organization) sets out various items that airport authorities must comply with, one of which is the public notice of bearing strength of airport pavement using the ACN-PCN (Aircraft Classification Number – Pavement Classification Number) method.

ACN is a number expressing the relative effect of an aircraft on airport pavement and is found in “Airplane Characteristics” published by the aircraft manufacturer that described the characteristics of each aircraft. PCN is a number expressing the bearing strength of airport pavement, and airport authorities around the world are required to publish the PCN of their airport in AIP (Aeronautical Information Publication).

By comparing ACN with PCN, it is easy to determine whether the aircraft can be operated or not. As shown in Figure, if PCN is equal or greater than ACN, normal operation is allowed, and if PCN is smaller than ACN, the airport authority decides to allow the overload operation, to allow the operation with weight restriction, or not to allow the operation.

ACN calculation method is established by the ICAO, but PCN calculation method is left to each airport authority. PCN calculation method in Japan is shown in the document “Manual for Public Notice of Airport Pavement Bearing Strength” by the Japan Civil Aviation Bureau of the Ministry of Land, Infrastructure Transport and Tourism.

Annex 14 was revised in 2022, and the ACN-PCN method used since November 26, 1981, will be abolished

on November 27, 2024, and the new ACR-PCR (Aircraft Classification Rating – Pavement Classification Rating) method will be applied from November 28, 2024. When Japan Civil Aviation Bureau revises the document “Manual for Public Notice of Airport Pavement Bearing Strength” in response to the revision of Annex 14, the author conducted research to establish the standard PCR calculation method in Japan considering the ACR calculation method established by the ICAO and the airport pavement design method in Japan.

2. Overview of ACR calculation method

The ACR calculation method established by the ICAO is as follows (F and R are for flexible pavement and rigid pavement, respectively). Unlike ACN, multilayer elastic analysis is used for ACR calculation.

- In the pavement structure shown in Table-1 and Table-2, base course thickness (F) / concrete slab thickness (R) is determined so that the vertical strain on the surface of subgrade is 1325μ (F) / the load stress on the underside of the concrete slab is 2.75 MPa (R) by the landing gear load (multiple wheels) of the aircraft.
- Derived single wheel load is calculated for the determined pavement structure. Specifically, a single wheel load with a tire contact pressure of 1.50 MPa is determined so that the vertical strain on the surface of subgrade is 1325μ (F) / the load stress on the underside of the concrete slab is 2.75 MPa (R).
- ACR is the calculated derived single wheel load (in 100 kgf unit) multiplied by two.

3. Consideration of PCR calculation method

Various studies were conducted to reflect the airport pavement design method in Japan, and the PCR calculation method was developed with some modifications to the ACR calculation method. For flexible pavement, elastic modulus of base course was set with no upper limit in the ACR calculation, while that was set with the upper limit in the PCR calculation. For rigid pavement, the allowable stress design method was used in the ACR calculation, while the fatigue design method was used in

the PCR calculation.

4. Conclusion

This PCR calculation method is described in the document “Manual for Public Notice of Airport Pavement Bearing Strength” published by Japan Civil Aviation Bureau in October 2, 2023.

Reference

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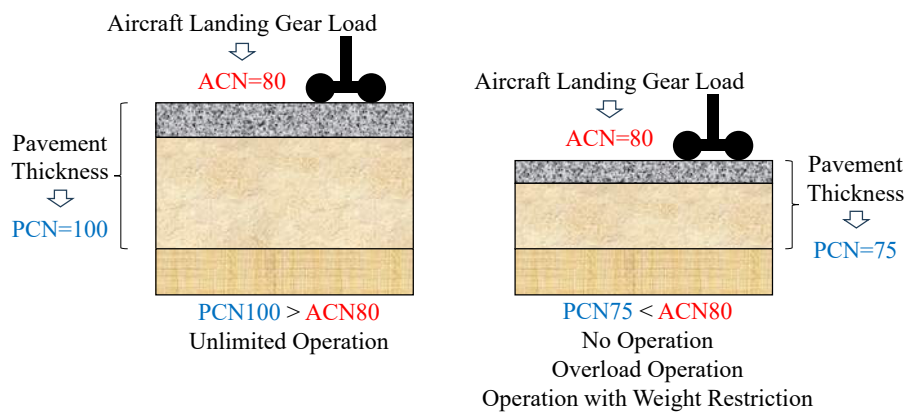


Fig: Determination of aircraft operation by using ACN-PCN method

Table-1: Flexible pavement structure for ACR calculation

Layer	Thickness (mm)	Elastic Modulus (MPa)
Surface Course	76 or 127 (Depending on the number of wheels)	1,379
Base Course	Variable	Set by equation
Subgrade	Infinite	50, 80, 120 or 200 (Depending on the subgrade strength categories)

Table-2: Rigid pavement structure for ACR calculation

Layer	Thickness (mm)	Elastic modulus (MPa)
Surface Course	Variable	27,579
Base Course	200	500
Subgrade	Infinite	50, 80, 120 or 200 (Depending on the subgrade strength categories)