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GCAA
ADVISORY CIRCULAR

AERODROME & GROUND AID
AC NO: GCAA AC/AGA/006

SUBJECT: OVERLOAD OPERATIONS

DATE INITIATED: JULY 15, 2016
**INITIATED BY: DIRECTOR AVIATION SAFETY
REGULATION**

1. PURPOSE

This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. The aerodrome operator may establish an alternative method of evaluation that is acceptable to the Authority. The purpose of this AC is to outline methodologies for determining and reporting airside pavement bearing strengths at Guyana airports. The document reviews Guyana's Aircraft/Pavement Load Rating (ALR/PLR) system and the International Civil Aviation Organisation (ICAO) Aircraft/Pavement Classification Number (ACN-PCN) method. Correlations between the two systems are presented to enable determination of Pavement Classification Numbers from existing Pavement Load Ratings.

2. APPLICABILITY

This is an initial Advisory Circular GCAA AC/AGA/006 is an initial issue and the effective date is January 1, 2017. This AC applies to Guyana airport operators and is also available to the aviation industry for information purposes.

3. GENERAL INFORMATION/CANCELLATION

Civil aviation regulations have established the criteria for the use of a pavement by an aircraft with an ACN higher than the PCN reported for that pavement. It also describes how to calculate declared distances and how RESA shall be incorporated into the calculations. Therefore, this AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

4. RELATED REFERENCES

- a. International Civil Aviation Organisation (ICAO) Annex 14 to the Convention on International Civil Aviation – International Standards and Recommended Practices: Aerodromes.
- b. ICAO – Document 9157 – AN/901 – Aerodrome Design Manual – Part 3 – Pavements.

5. CONTACT INFORMATION

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6. ACRONYMS, DEFINITION AND TERMS USED IN THIS DOCUMENT

6.1 Acronyms and its meanings:

- a. **AC** - Advisory Circular.
- b. **ACN** - Aircraft Classification Number.
- c. **ALR** - Aircraft Load Rating.
- d. **CBR** - California Bearing Ratio.
- e. **FAA** - Federal Aviation Administration
- f. **ICAO** - International Civil Aviation Organisation.
- g. **PCN** - Pavement Classification Number.
- h. **PLR** - Pavement Load Rating.
- i. **RESA** - Runway End Safety Area.

6.2 Definitions/Terms and their meanings:

- a. **Aircraft Classification Number (ACN).** A number expressing the relative structural loading effect of an aircraft on a pavement for a specified standard subgrade category.
- b. **Aircraft Load Rating (ALR).** A number expressing the relative structural loading effect of an aircraft on a pavement (historical Transport Canada pavement strength reporting format).
- c. **Bearing Modulus (k).** A measure of the stiffness of supporting layers beneath a concrete slab. It is measured on the surface of the layer immediately beneath the concrete slab by applying a load through a 750 mm diameter plate to produce a deflection of 1.25 mm. The unit load on the plate (in Pa) is then divided by the deflection of 1.25 mm to give a bearing modulus in units of MPa/m.
- d. **Bearing Strength.** The measure of the ability of a pavement to sustain the applied load. The bearing strength or bearing capacity is the pavement's ability to accept the loads imposed by an aircraft while maintaining its structural integrity. It can be described as the maximum amount of weight or pressure or some other variable that a structure can hold before collapsing. Bearing strength is roughly defined as the maximum bearing load that can be placed on a structure before it will fail, divided by the area that is bearing the weight. This calculation is regularly used in the engineering field for the construction of airfield surface structure for operation of aircraft.
- e. **California Bearing Ratio (CBR).** A measure of the load bearing capacity of a given sample of soil expressed as a ratio relative to the load bearing capacity of crushed limestone.

Note: The load bearing capacity of crushed limestone is expressed as a CBR of 100.
- f. **Composite Pavement.** A flexible asphalt pavement or a rigid concrete pavement that has received an overlay of flexible or rigid construction.

- g. **Flexible Pavement.** A pavement structure that is designed on the principle of distributing traffic loads to the subgrade, and depends on aggregate interlock, particle friction, and cohesion for stability. This type of pavement includes flexible and semi rigid structures, as well as certain types of composite structures, e.g. a formally rigid, badly cracked pavement reinforced with material treated with hydro carbon binders. A flexible pavement structure is typically composed of several layers of material with better quality materials on top where the intensity of stress from traffic loads is high and lower quality materials at the bottom where the stress intensity is low. Flexible pavements can be analysed as a multilayer system under loading.
- h. **Pavement.** An artificially covered surface (structure) for runways, taxiways, aircraft parking areas (parking stands) ramps and aprons of airfields used to ensure uninterrupted operation and manoeuvring of aircraft. It is the structural material layers above the subgrade that both comprises and underlay an airside movement area surface, including the subbase, base, and wearing courses.
- i. Surface layer or wearing course;
 - ii. Base layer;
 - iii. Sub-base layer; and
 - iv. Sub-grade.
- i. **Pavement Classification Number (PCN).** A number expressing the bearing strength of a pavement for unrestricted operations.
- j. **Pavement Equivalent Granular Thickness (t).** The thickness of a pavement constructed of granular materials alone that would have a capacity for the distribution of traffic loads to the subgrade equivalent to that of a flexible pavement constructed with layers of various materials having different load characteristics.
- k. **Pavement Load Rating (PLR).** A number expressing the bearing strength of a pavement for unrestricted operations (historical Transport Canada pavement strength reporting format).
- l. **Pavement Life.** This is the period at the end of which the bearing strength of the pavement becomes inadequate to bear, without risk, the same traffic in the course of the following year, making necessary a general reinforcement or reduction in traffic. The normal life of a pavement is ten (10) years and pavements are generally designed for that period. However, due to various circumstances another value may be established for the life of a pavement.
- m. **Rigid Pavement.** A pavement structure that depends on the tensile beam strength of a Portland cement concrete slab for the support of traffic loads. This type of pavement includes rigid structures and certain types of composite structures, e.g. a rigid pavement renewed by applying a wearing course treated with hydro carbon binders. A rigid pavement structure is composed of a hydraulic cement concrete surface course and underlying base and sub-base courses (if used). The surface course (concrete slab) is the stiffest layer and provides the majority of strength. The base or sub-base layers are orders of magnitude less stiff than the surface but still make important contributions to pavement drainage and frost protection and provide a working platform for construction equipment.
- n. **Subgrade.** The soil prepared and compacted to support a pavement structure.

- o. **Subgrade Bearing Strength (S).** The load kilonewtons (kN) that will produce a deflection of 12.5 mm after 10 repetitions of load when the load is applied through a 750 mm diameter rigid plate. The bearing strength is variable with location and time of year, and the value used to characterize subgrade bearing strength is the 25th percentile value exhibited during the spring thaw period (lower quartile, spring-reduced value).
- p. **Traffic.** Traffic in connection with aerodromes ground manoeuvring is the movement of aircraft and vehicles on the airfield surface structure or manoeuvring and parking areas (pavement). Traffic can be further described as follows:
- i. "One-movement (actual)" is the application to the pavement of a load by an actual undercarriage leg during one manoeuvre (take off, landing taxiing). The number of actual movements is generally higher than the number of movements accounted for by the operator (take-offs and landings).
 - ii. An actual load "P" is the load actually applied by an aircraft undercarriage leg.
 - iii. Actual traffic consists of different movements of varying actual loads applied by actual undercarriage legs of different categories.
 - iv. The "normal design load P" is the load taken into account in formulas or graphs for the purpose of designing the pavement. It may be "weighed" or not, depending on the function of the pavement involved.
 - v. Normal Traffic is traffic consisting of ten movements per day by the aircraft producing the design load over an expected pavement life of at least 10 years.
 - vi. The "allowable load Po" of a pavement is the load on an undercarriage leg (actual or fictitious) calculated according to the design concept as being allowable at the rate of ten movements per day over ten years.
 - vii. An "equivalent movement" is the application of a reference load by an undercarriage leg.
 - viii. "Equivalent traffic" corresponds to actual traffic reduced to a number of equivalent movements.
 - ix. The "potential" of a pavement on a given date is represented by the number of equivalent movements which it can accept during its residual life.
- q. **Types of Design.** Generally, two types of design are recommended for pavements at aerodromes in Guyana:
- i. Optimized design (or optimized design method): design which takes into account all aircraft types having a significant effect on the pavement. This method is preferable if sufficiently reliable and accurate traffic forecasts are available throughout the expected life of the pavement.
 - ii. General design (or general design method): design in terms of a reference load which the pavement must support. In practice, this method is mainly used at a level of preliminary studies or in the absence of accurate data. The reference load is evaluated in terms of the anticipated utilisation of the aerodrome, the characteristics of aircraft in service or at the planning stage, and the specific role of the pavement in question.

7. DETERMINATION OF AIRPORT PAVEMENT BEARING STRENGTH

- a. The bearing strength of airside pavement operational surfaces should be determined on behalf of the airport operating authority by a professional engineer or engineering consulting firm experienced in the measurement and analysis of the bearing strength of airport pavements, in determining their ability to support aircraft loads, and in assessing the effect that aircraft loads are likely to have on the future structural performance and condition of the pavement.
- b. The determination of airport pavement bearing strength should be made based on the results of in-situ pavement strength tests combined with a knowledge of the thicknesses and strength properties of the various material layers comprising the pavement structure.
- c. An established and industry recognized engineering methodology consistent with the pavement design model and construction type should be used to determine the structural capability of the pavement to support proposed aircraft loads and traffic levels. Selection of an appropriate methodology should also take into account any strength and/or other pavement material test results that may already be available for the pavement.
- d. The bearing strength of a pavement should be reviewed and re-determined when the structural composition and/or properties of the pavement change as a result of new or restorative construction or when a significant change in the structural condition of the pavement has occurred.
- e. As a minimum, the bearing strength of a pavement should be reviewed, re-affirmed or re-determined as appropriate at least once every 10 years. As part of the review process, consideration should be given to retesting the strength of all or selected pavements at the airport.

8. HISTORICAL AIRCRAFT/PAVEMENT LOAD RATING SYSTEM

8.1 Aircraft/Pavement Load Rating System

The Aircraft/Pavement Load Rating (ALR/PLR) system is presented in this AC for historical reference purposes and to provide a method for determination of PCN values from PLR values using the figures/equations given subsequently.

8.2 Aircraft Standard Gear Loadings

The ALR/PLR system is based on 13 standard aircraft gear loadings which span the range of aircraft loadings. The loading characteristics of the standard aircraft gear are given in Table 1. Pavement thickness design requirements for these standard gear loadings are shown in Figures 1 and 2. Figure 1 for flexible pavement structures gives the pavement equivalent granular thickness required as a function of subgrade bearing strength. Figure 2 for rigid pavement structures gives the concrete slab thickness required as a function of the supporting bearing modulus beneath the slab.

8.3 Aircraft Load Ratings

- a. An Aircraft Load Rating (ALR) is a number expressing the relative structural loading effect of an aircraft on a pavement. The ALR is determined by superimposing the aircraft pavement design requirements on Figures 1 and 2 and comparing the requirements to those for the standard gear loadings. The load rating of the aircraft is defined as the standard gear loading which has the same pavement thickness requirement as the aircraft.

- b. Due to variations in the landing gear loading characteristics of actual aircraft, their design thickness curves usually do not fall exactly on or parallel to the standard gear curves (Figures 1 and 2) over the entire range of subgrade support values. As a result, aircraft load ratings vary depending on the subgrade bearing strength in the case of flexible pavements and on the bearing modulus in the case of rigid pavements. For this reason, aircraft load ratings for flexible pavements are determined and reported at four standard subgrade bearing strengths (50, 90, 130 and 180 kN). Similarly, aircraft load ratings for rigid pavements are determined and reported at four standard bearing modulus values (20, 40, 80 and 150 MPa/m). A maximum (nominal) ALR is also reported at each aircraft weight so that pavement strength suitability can be assessed quickly without the need for detailed subgrade strength or bearing modulus values.
- c. In order to facilitate the determination of aircraft load ratings, the standard gear load design curves of Figures 1 and 2 have been redrawn in Figures 3 and 4 respectively for the standard subgrade/bearing modulus strength values; equations are also given for the curves. Aircraft load ratings are determined by first calculating the aircraft's design pavement thickness requirements at the four standard subgrade/bearing modulus strengths and then using the appropriate curve or equation to compute the ALR at each subgrade support strength.

9. AIRCRAFT/PAVEMENT CLASSIFICATION NUMBER METHOD

9.1 Aircraft/Pavement Classification Number Method

In order that pavement strengths could be reported and understood internationally, ICAO developed the Aircraft Classification Number-Pavement Classification Number (ACN-PCN) method. The ICAO ACN-PCN reporting method is fully detailed in TP 312 5th Edition, ICAO Annex 14 and ICAO Document 9157. With the publication of TP312 5th Edition, it is the intent that the standard method for reporting pavement strength will be the ACN-PCN method.

9.2 Aircraft Classification Numbers

- a. The Aircraft Classification Number (ACN) expresses the relative structural loading effect of an aircraft on different pavement types (flexible or rigid) for specified standard subgrade/bearing modulus values. The ACN of an aircraft is defined as being the load (kg) divided by 500 which acting on a standard single wheel (at 1.25 MPa tyre pressure) will have the same pavement thickness design requirements as the aircraft gear load being classified. The equivalency of pavement thickness design requirements is determined using the design methods of the Portland Cement Association for rigid pavements, and with some minor modifications, the historical CBR design methods of the Federal Aviation Administration (FAA) for flexible pavements. Full details on these methods and computer programs for determining ACN's are contained in ICAO Document 9157.
- b. Using this approach, ACN's for flexible pavements are reported at four standard subgrade California Bearing Ratio (CBR) values of 3, 6, 10, and 15 which correspond to Canadian subgrade bearing strengths of 50, 90, 130 and 180 kN respectively. Similarly, ACN's for rigid pavements are reported at four standard bearing modulus values (20, 40, 80 and 150 MPa/m). The classification number of an aircraft varies substantially, depending on the subgrade bearing strength in the case of flexible pavements and on the bearing modulus in the case of rigid pavements.
- c. ACN's are computed only for aircraft having an apron (ramp) mass greater than 5700 kg (56 kN or 12,600 lbs). Under the ACN system, the loading effect of aircraft having a mass equal to or less than 5700 kg is reported in terms of the aircraft maximum mass and tyre pressure.

- d. Official ACN values are provided by the aircraft manufacturer.
- e. The U.S. FAA has developed software for calculating ACN values in accordance with the ICAO ACN-PCN method. The software is called ICAO-ACN 1.0 and may be downloaded from the FAA web site. The software is useful for calculating ACN values under various conditions but as stated above, the official ACN values are obtained from the aircraft manufacturer.

9.3 Pavement Classification Numbers

- a. The method of determining pavement bearing strength is not specified under the ACN-PCN method, but is left open to the choice of each individual state. Pavement strength determinations may be made on the basis of field measured data or simply on the basis of past experience with aircraft that have used the facility without causing pavement structural damage. Regardless of how it is determined, bearing strength is to be reported in terms of a PCN. The PCN reported is to indicate that an aircraft having an ACN equal to or less than the reported PCN can operate on the pavement without restriction subject to any limitation on tyre pressure.
- b. In addition to the actual PCN value, the PCN reporting code contains other information such as pavement type (flexible or rigid), subgrade strength category, maximum allowable tyre pressure and the evaluation method used to determine the pavement strength. Full details of the PCN reporting code are given in TP 312 5th Edition and in ICAO Annex 14 and are summarized with examples in Table 5.
- c. The PCN is the first part of a five-part strength code (e.g. 40/F/B/1.0 MPa/T) that includes the following information.
 - i. The PCN
 - The PCN is a number that expresses the bearing strength of a pavement (the higher the number, the stronger the pavement) for unrestricted aircraft operations.
 - ii. Pavement Type for ACN/PCN Determination
 - Rigid Pavement - indicated by the Code Letter "R"
 - Flexible Pavement - indicated by the Code Letter "F"
 - iii. Subgrade Strength Category
 - High Strength - indicated by the Code Letter "A"
 - Medium Strength - indicated by the Code Letter "B"
 - Low Strength - indicated by the Code Letter "C"
 - Ultra-Low Strength - indicated by the Code Letter "D"
 - iv. Maximum Allowable Tyre Pressure Category or Value
 - Unlimited - indicated by the Code Letter "W"
 - High - indicated by the Code Letter "X"
 - Medium - indicated by the Code Letter "Y"
 - Low - indicated by the Code Letter "Z"

It is preferable to state the maximum allowable tyre pressure in MPa rather than the tyre pressure category. Tyre pressure limitations are generally only applied to flexible

pavements. If a tyre pressure limit does not apply to a pavement, the Code Letter "W" is used.

v. Strength Evaluation Method

- Technical Evaluation - indicated by the Code Letter "T"
- Using Aircraft Experience - indicated by the Code Letter "U"

vi. The bearing strength of pavements intended for use by aircraft of apron (ramp) mass equal to or less than 5700 kg (56 kN or 12,600 lbs) is made available by reporting:

- the maximum allowable aircraft mass, and
- the maximum allowable tyre pressure. Example: 4000 kg/0.50 MPa

10. AIRCRAFT OPERATIONS UNDER THE AIRCRAFT/PAVEMENT CLASSIFICATION NUMBER SYSTEM

- Determining the structural suitability of a pavement for aircraft operations using the ACN-PCN method follows the same general process as that used under the ALR-PLR system but with some technical differences.
- The airport operator must first have available the five part PCN reporting code for the pavement. Reference is then made to publish Aircraft Classification Number tables to determine the aircraft ACN for the pavement type (flexible or rigid) and the subgrade strength level reported in the 2nd and 3rd parts of the PCN code. ACN values at other than the aircraft maximum/minimum weights can be calculated with acceptable accuracy by linear interpolation between the ACN values given in the tables or by using the FAA software referenced in Section 6.2 (5). From a structural viewpoint, an aircraft can operate on a pavement provided that:
 - the ACN of the aircraft is equal to or less than the PCN assigned to the pavement (for the given pavement type and subgrade strength code), and
 - the tyre pressure of the aircraft does not exceed the tyre pressure restriction (if any) assigned to the pavement, and
 - subject to any limitation on the maximum allowable aircraft mass (primarily applicable to light aircraft of mass equal to or less than 5700 kg).
- The PCN strength codes reported for pavements are valid on a year-round basis and take into account seasonal variations and reductions in strength which may occur as a result of the springtime weakening of subgrade soils.
- Aircraft operators planning flight(s) into a particular airport should notify and obtain prior permission from the airport operating authority. Application for approval of aircraft operations that marginally exceed the reported pavement strength limit may also be made to the airport operating authority but usually require a detailed engineering evaluation prior to approval. Further information on pavement overload operations is given in Section 14.

11. DETERMINATION OF TYRE PRESSURE LIMITATIONS

- For rigid pavement systems (Portland cement concrete), aircraft tyre pressures will have little effect on the pavement surface. Rigid pavements inherently possess adequate surface stability and normally do not require tyre pressure limitations. Rigid pavements can usually be rated as code W.

- b. For flexible asphaltic concrete pavement systems, suggested tyre pressure restrictions are given in Table 2 based on the thicknesses of asphalt surface and granular base course layers. However, tyre pressure restrictions should also take into account the quality of the asphalt mixture (stability of the asphalt mix in resisting shearing) and climatic conditions.

12. DETERMINATION OF PCN VALUES FROM PLR VALUES

- a. The relationship between classification numbers and load ratings is shown in Figures 7 to 14. Figures 7 to 10 plot flexible pavement ACN values against corresponding ALR values for the 46 aircraft listed in Table 6 at each of the four standard subgrade bearing strengths. Figures 11 to 14 are similar ACN/ALR plots for rigid pavements for the 46 aircraft listed in Table 7 at each of the four standard bearing modulus levels.
- b. Aircraft classification numbers and load ratings may be viewed as a relative ranking or indexing of the severity of aircraft loadings, and there is not a one-to-one relationship between these rankings because of the different methods used for their determination. Figures 7 to 14 suggests that PCN numbers correlate with PLR ratings with sufficient accuracy to determine the former from the latter when reporting pavement bearing strengths.
- c. Table 8 gives PLR to PCN conversion tables and equations for flexible and rigid pavements based on the various regression curves plotted in Figures 7 to 14.
- d. To make the conversion, a knowledge is required of subgrade bearing strength in the case of flexible pavements, and bearing modulus in the case of rigid pavements. This information is not reported under the Pavement Load Rating system, but should be available from airport pavement technical data inventories. Using this information in conjunction with Tables 8 and 5, the PCN value and the entire PCN code can be determined.
- e. Table 9 provides examples of PLR to PCN conversions for flexible (asphalt), rigid and gravel surfaced pavements.
- f. In order to promote consistency of results, it is recommended that when both PLR and PCN codes are to be reported, rounded-up PLR values be used to convert PLR to PCN as illustrated in the example of Table 9. By reporting rounded-up strength values, the PLR system inherently accommodates a limited degree of pavement overloading whereas the PCN method permits 5-10% overloads based on the reported PCN number (reference Section 14). However, diligence must be exercised to ensure that 5-10% overloads are not "automatically" applied to PCN values that have been derived by conversion of rounded up PLR values.
- g. If only PCN codes are reported, then the more precise PLR value and the regression equations may be used to convert PLR to PCN, to determine a more conservative (precise) PCN value. In the example of Table 9 for flexible pavements, the rounded-up PLR value of 9 is derived from "S" and "t" values using Figure 1. The more precise PLR value would be approximately 8.6 (interpolated between the curves for PLR 8 and PLR 9). Using the equation for subgrade category D ($S = 50$ kN), would give a PCN of 44 as compared to a PCN of 50 derived from the rounded-up PLR value. Similarly, in the example of Table 9 for rigid pavements, the rounded up PLR value of 11 is derived from "k" and "h" values using Figure 2. The more precise PLR value would be approximately 10.2 (interpolated between the curves for PLR 10 and PLR 11). Using the equation for subgrade category B ($k = 100$ MPa/m), would give a PCN of 49 as compared to a PCN of 60 derived from the rounded up PLR value.

13. PAVEMENT STRENGTH REPORTING

- a. The operating authority for every certified airport in Guyana is required to determine the bearing strength of all airside pavement operational surfaces at the airport. For international airports, the resulting strength information is to be made available (reported) using the standard ICAO PCN reporting code format which is understood world-wide. Other airports are also encouraged to use the standard PCN reporting code.
- b. In some cases, airport authorities may publish airside pavement strength information (PCN reporting codes) in the form of a computerised chart similar to the one shown in Figure 15. Other airport authorities may publish the data in a tabular format. Regardless of the publishing format, it is imperative that pavement strength information be made available (ICAO-PCN code) in a format that can easily be interpreted and applied by operational personnel. The reported airside pavement strengths can then be compared to corresponding aircraft ACN values to determine those aircraft which can operate on the pavements.
- c. For the purpose of reporting pavement strength(s), runway operational surfaces should be assigned only one pavement strength rating (i.e. one PCN value) which should be representative of the overall strength of the runway and which should apply to the entire length of the runway. For runway pavements of varying strengths, engineering judgement may be required to determine a representative overall pavement strength rating. Factors that may be considered include the location and extent of weaker pavement sections and the pavement condition.
- d. Taxiway and apron areas should be sectioned for pavement strength reporting surfaces as deemed appropriate by the airport authority to account for traffic flow and usage patterns.
- e. The pavement strength values reported should apply on a year-round basis and should take into account any seasonal variations which may result in a temporary reduction in pavement strength. Pavement strength information is available from the airport operating authority.

14. PAVEMENT OVERLOAD OPERATIONS

- a. Aircraft with ACN's greater than the PCN reported for a pavement may still be allowed to use the pavement subject to the approval of the airport operating authority. However, the airport authority should fully understand the implications of allowing overload operations in terms of the accelerated structural deterioration and the reduction in pavement service life which may occur.
- b. The overloading of pavements can result either from loads that are too large or from a substantially increased load application rate, or both. Loads larger than the original design or as-built evaluated load may shorten the pavement service life, while smaller loads will usually have a minimal effect on pavement deterioration.
- c. With the exception of massive overloading, pavements in their structural behaviour are not subject to a particular limiting load above which they will suddenly or catastrophically fail. Behaviour is such that a pavement can sustain a definable load for an expected number of repetitions during its service life. As a result, occasional minor overloading is acceptable, when expedient, with only limited loss in pavement life expectancy and relatively small acceleration of pavement deterioration.

- d. ICAO Annex 14, Attachment A, Section 20 gives the following suggested criteria for determining the acceptability of aircraft operations which overload the pavement:
- i. For flexible pavements, occasional movements by aircraft with ACN not exceeding 10 per cent above the reported PCN should not adversely affect the pavement.
 - ii. For rigid or rigid composite pavements, in which a rigid pavement layer provides a primary element of the structure, occasional movements by aircraft with ACN not exceeding 5 per cent above the reported PCN should not adversely affect the pavement.
 - iii. If the pavement structure is unknown, a 5 per cent limitation should apply.
 - iv. The annual number of overload movements should not exceed approximately 5 per cent of the total annual aircraft movements.
- e. Overload movements defined by the criteria above should not normally be permitted on pavements exhibiting signs of distress or failure. Furthermore, overloading should also be avoided during any periods of thaw following frost penetration, or when the strength of the pavement or its subgrade could be weakened by water.
- f. Where overload operations are conducted, the airport authority should inspect and review the structural condition of the pavement regularly to ensure that the pavement is not being damaged and that the criteria being used to allow the overload operations is appropriate for the particular pavement. Excessive repetition of overloads can cause severe shortening of pavement life or require premature major rehabilitation of the pavement
- g. For those aircraft operations where the magnitude of overload and/or the frequency of use exceed the limits of the criteria given above, it is recommended that the advisability of the allowing the operation be determined on the basis of a detailed engineering analysis comparing the individual aircraft load to the structural capability of the pavement.
- h. The airport authority may also wish to have a detailed engineering analysis of the airside pavements carried out to determine the maximum overloads which could safely be allowed in the event that an "emergency only" type of aircraft operation is required on short notice. The determination of "emergency only" overload limits should be based on ensuring the safety of the aircraft from pavement surface "break-through" during the "emergency" operation.

Approved by:



Chaitrani Heerani
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APPENDIX: A - TABLES: 1 TO 9
TABLE 1: AIRCRAFT STANDARD GEAR LOADINGS

STANDARD GEAR LOAD RATING	CHARACTERISTICS OF STANDARD GEAR LOADINGS							
	SINGLE WHEEL GEAR		DUAL WHEEL GEAR			DUAL TANDEM GEAR		
	GEAR LOAD	TYRE PRESSURE	GEAR LOAD	TYRE PRESSURE	DUAL TYRE SPACING	GEAR LOAD	TYRE PRESSURE	DUAL TANDEM SPACING
	(kN)	(MPa)	(kN)	(MPa)	(cm)	(kN)	(MPa)	(cm)
1	20	0.30						
2	30	0.35						
3	45	0.40						
4	60	0.45	80	0.50	50			
5	80	0.50	110	0.60	55			
6	110	0.55	130	0.65	60			
7	140	0.60	170	0.70	65			
8			220	0.85	70			
9			290	1.05	75	440	1.10	65 x 115
10			400	1.15	90	660	1.20	90 x 150
11						900	1.55	110 x 165
12						1120	1.80	115 x 165
13						1380	1.80	115 x 165

TABLE 2: TYRE PRESSURE RESTRICTIONS (MPa) FOR ASPHALT SURFACED PAVEMENTS

ASPHALT THICKNESS (cm)	BASE COURSE THICKNESS (cm)								
	15	16	17	19	19	20	21	22	>=23
5.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0
7.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0
7.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0
8.0	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
9.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
9.5	1.0	1.0	1.0	1.0	1.0	1.0			
10.0	1.0	1.0	1.0	1.0	1.0				
10.5	1.0	1.0	1.0	1.0					
11.0	1.0	1.0	1.0						
11.5	1.0	1.0							
12.0	1.0								
>=12.5									

**1.75 MPa
or
No Restriction**

NOTES: Tyre pressure restrictions are "0.5 MPa", "1.0 MPa", "1.75 MPa" or "No Restriction". It is at the discretion of the airport operating authority to select either "1.75 MPa" or "No Restriction" depending on site specific conditions for pavements falling into this category. "Asphalt thickness" refers to the actual thickness of the asphalt surface layer(s).

TABLE 3: TYPICAL SUBGRADE BEARING STRENGTHS

NOTE: Guyana does not have seasonal climate, such as "Fall or Spring, Winter or Summer", therefore, Table 3 is not applicable. Consequently, Table 3 was deleted.

TABLE 4: GRANULAR EQUIVALENCY FACTORS FOR PAVEMENT MATERIALS

PAVEMENT MATERIAL	GRANULAR EQUIVALENCY FACTOR
Selected Granular Sub-Base	1
Crushed Gravel or Stone Base	1
Water-bound Macadam Base	1 ½
Bituminous Stabilised Base	1 ½
Cement Stabilised Base	2
Asphaltic Concrete (Good Condition) Asphaltic	2
Concrete (Poor Condition) Portland Cement	1 ½
Concrete (Good Condition) Portland Cement	3
Concrete (Fair Condition) Portland Cement	1 ½
Concrete (Poor Condition)	2

NOTE: The equivalent granular thickness of a layer is calculated by multiplying the layer thickness by the granular equivalency factor for the material in the layer.

EXAMPLE

Given: A pavement structure of 8 cm Asphaltic Concrete (A.C.) + 25 cm base + 20 cm sub-base
 Problem: To determine the equivalent Granular Thickness Solution:

LAYER COMPONENT		GRANULAR EQUIVALENCY FACTOR	EQUIVALENT GRANULAR THICKNESS
8 cm A.C.	x	2	16 cm
25 cm Base	x	1	25 cm
20 cm Sub-base	x	1	20 cm
			<u>61 cm</u> (Total Equivalent Granular Thickness)

TABLE 5: PAVEMENT CLASSIFICATION NUMBER (PCN) REPORTING CODES

PAVEMENT TYPE FOR ACN-PCN DETERMINATION		CODES
<u>Rigid Pavement</u>		R
<u>Flexible Pavement</u>		F
<i>Note: If the actual pavement construction is composite or non-standard, include a note to that effect (see Example 2 below).</i>		
SUBGRADE STRENGTH CATEGORY		CODES
<u>High Strength</u>	: Characterised by $k=150 \text{ MN/m}^3$ and representing all k values above 120 MN/m^3 for rigid pavements, and by $\text{CBR}=15$ and representing all CBR values above 13 for flexible pavements.	A
<u>Medium Strength</u>	: Characterised by $k=80 \text{ MN/m}^3$ and representing a range in k of 60 to 120 MN/m^3 .	B
<u>Low Strength</u>	: Characterised by $k=40 \text{ MN/m}^3$ and representing a range in k of 25 to 60 MN/m^3 for rigid pavements, and by $\text{CBR}=6$ and representing a range in CBR of 4 to 8 for flexible pavements.	C
<u>Ultra-Low Strength</u>	: Characterised by $k=20 \text{ MN/m}^3$ and representing all k values below 25 MN/m^3 for rigid pavements, and by $\text{CBR}=3$ and representing all CBR values below 4 for flexible pavements.	D
MAXIMUM ALLOWABLE TIRE PRESSURE CATEGORY OR VALUE		CODES
The maximum reported tire pressure is reported by either:		
i) Using the code letters listed below:		
<u>Unlimited</u>	: No tyre pressure limitation.	W
<u>High</u>	: Tyre pressure limited to 1.75 MPa	X
<u>Medium</u>	: Tyre pressure limited to 1.25 MPa	Y
<u>Low</u>	: Tyre pressure limited to 0.50 MPa	Z
or by:		
ii) Stating the actual tire pressure limitation in MPa, except where no tire pressure limitation is applicable, the code W is reported.		
<u>Technical Evaluation</u>	: Representing the results of a specific engineering study of the structural characteristics of the pavement and application of the pavement structural behaviour technology.	T
<u>Using Aircraft Experience</u>	: Representing a knowledge of the specific type and weight of aircraft satisfactorily being supported by the pavement under regular use.	U
<p>Note 1: The following examples illustrate how pavement strength data are to be reported using the ACN-PCN method.</p> <p>Note 2: For paved surfaces, the PCN takes into account any seasonal variations, which may result in a temporary reduction in pavement strength. For non-paved surfaces such as gravel, any seasonal reduction from the reported strength should be indicated by means of an explanatory note.</p> <p>Example 1: If the bearing strength of a rigid pavement, resting on a medium strength subgrade, has been assessed by technical evaluation to be PCN 80 and there is no tire pressure limitation, then the reported information would be:</p> <p style="text-align: center;">PCN 80/ R/ B/ W/ T</p> <p>Example 2: If the bearing strength of a composite pavement, behaving like a flexible pavement and resting on a high strength subgrade has been assessed by using aircraft experience to be PCN 50 and the maximum allowable tire pressure is 1.25 MPa, then the reported information would be:</p> <p style="text-align: center;">PCN 50/ F/ A/ 1.25 MPa/ U (Preferred Method) (or PCN 50/ F/ A/ Y/ U) Note: Composite construction.</p> <p>Example 3: If the bearing strength of a flexible pavement, resting on a medium strength subgrade, has been assessed by technical evaluation to be PCN 40 and the maximum allowable tire pressure is 0.80 MPa, then the reported information would be:</p> <p style="text-align: center;">PCN 40/ F/ B/ 0.80 MPa/ T</p> <p>Example 4: If a pavement is subject to a B747-400 all-up mass limitation of 390,000 kg, then the reported information would include the following note:</p>		

Note: the reported PCN is subject to a B747-400 all-up mass limitation of 390 000 kg.

TABLE 6: ACN/ALR COMPARISON FOR FLEXIBLE PAVEMENTS (PAGE 1 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Flexible Pavements for Subgrade Bearing Strength – S (kN)			
				Dual	Tandem	50	90	130	180
Airbus A300-B4-200	1627	46.97	1.28	90.2	139.7	80/10.98	63/10.88	52/10.89	46/10.70
	1236					55/9.63	42/9.51	35/9.39	32/9.49
Airbus A310-200	1509	46.6	1.46	92.7	139.7	72/10.41	55/10.37	46/10.39	41/10.32
	800					29/7.15	22/7.35	20/7.66	19/----
Airbus A321-200	877	47.46	1.46	92.7	----	63/9.83	58/10.16	52/10.52	49/10.83
	461					30/7.10	26/7.66	24/8.13	23/9.05
Airbus A330-200	2264	47.5	1.42	139.7	198.1	97/11.27	72/11.13	62/11.13	57/11.06
	1650					61/9.62	46/9.45	41/9.35	39/10.30
Airbus A340-600	3590	33.0	1.42	140	198	112/11.76	83/11.61	70/11.61	65/11.44
	1750					39/7.92	31/7.93	28/8.65	27/9.62
A380-800	5514	28.5	1.47	153	170	106/12.21	75/11.52	62/10.97	56/11.02
	2758			Six Wheel Gear		36/7.55	28/7.64	25/8.51	23/9.46
Antonov AN-124-100	3844	47.5	1.03	99.5	165	83/12.02	59/11.38	46/10.90	40/9.32
	2000			10 Wheel Gear		30/8.22	21/7.12	18/7.36	16/----
Antonov AN-225	5884	47.5	1.13	87	175	101/12.89	72/12.36	57/12.04	49/11.50
	4500			14 Wheel Gear		67/11.39	47/10.88	37/10.47	33/9.42
B1-B Bomber	2123	47.5	1.65	85	145	113/12.18	94/12.24	80/12.34	71/12.38
	1400					66/10.09	52/10.17	44/10.34	40/10.48
BAC-111 Series 500	467	47.5	1.10	51.8	----	35/8.22	33/8.59	31/8.85	29/9.09
	250					18/5.90	16/6.37	14/----	13/----
B707-120	1150	47.0	1.17	86	142	50/9.42	38/9.27	32/9.11	29/9.15
	700					25/6.83	19/6.86	17/7.24	16/----
B707-320	1484	47.5	1.24	86.0	142.0	72/10.67	57/10.58	47/10.60	42/10.39
	800					31/7.49	23/7.50	20/7.63	19/----
B720	1045	47.8	1.01	86.0	142.0	45/9.15	34/8.85	28/8.49	26/----
	700					25/7.01	19/6.75	17/7.02	16/----
B727-200 Standard	770	47.5	1.15	86.4	----	55/9.56	50/9.80	44/10.00	42/10.18
	450					30/7.23	25/7.55	23/7.72	23/----

TABLE 6: ACN/ALR COMPARISON FOR FLEXIBLE PAVEMENTS (PAGE 2 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Flexible Pavements for Subgrade Bearing Strength – S (kN)			
				Dual	Tandem	50	90	130	180
B727-200 Advanced	934	47.5	1.19	86.4	----	69/10.35	64/10.56	57/10.83	53/11.03
	450					30/7.21	25/7.57	23/7.79	23/----
B737-100	445	47.5	1.02	77.5	----	30/7.43	26/7.65	23/7.76	23/----
	260					16/5.40	14/5.74	12/----	12/----
B737-200	572	47.5	1.26	77.5	----	41/8.40	37/8.71	32/9.04	31/9.34
	300					19/5.97	16/6.52	15/7.04	15/----
B747-100 SR	2690	23.8	1.04	111.8	147.3	58/9.74	42/9.38	35/8.92	33/9.42
	1600					27/6.88	21/6.45	18/7.38	18/----
B747-200	3720	23.8	1.38	111.8	147.3	91/11.16	70/11.01	57/11.00	51/10.76
	1750					31/7.17	24/7.26	21/7.92	20/----
B747-400	3905	23.8	1.38	111.8	147.3	97/11.41	75/11.26	61/11.23	55/11.04
	1800					32/7.30	24/7.33	22/7.98	21/8.89
B757-200	1134	47.5	1.24	86.4	114.3	55/9.62	43/9.41	35/9.21	31/9.25
	570					21/6.13	16/6.27	14/6.91	13/----
B767-200	1410	47.5	1.31	114.3	142.2	63/9.76	46/9.50	39/9.31	36/9.79
	800					27/6.74	21/6.80	19/7.61	18/----
B777-200 LR	3345	46.9	1.50	139.7	144.8	118/12.84	87/12.14	70/11.64	62/11.03
	1424			Six Wheel Gear		32/7.15	24/7.20	22/8.18	20/9.13
B777-300	2945	47.4	1.48	139.7	144.8	101/12.11	73/11.40	59/10.77	53/10.72
	1562			Six Wheel Gear		38/7.79	28/7.46	25/8.39	23/9.34
Convair 990	1135	48.5	1.28	61.0	118.0	59/10.23	49/10.28	42/10.37	37/10.34
	600					25/7.11	20/7.33	17/7.45	16/----
Dassault Falcon 900	202	47.5	1.30	42.0	----	15/5.62	14/6.28	12/----	11/----
	103					7/4.25	6/----	5/----	5/----
DC-3	147	46.8	0.31	----	----	12/3.97	10/----	7/----	5/----
	80					7/2.26	5/----	4/----	3/----
DC-4	335	46.8	0.53	74.0	----	21/6.32	17/5.64	15/----	12/----
	200					11/4.07	9/----	8/----	6/----

TABLE 6: ACN/ALR COMPARISON FOR FLEXIBLE PAVEMENTS (PAGE 3 OF 4)

Aircraft Model	Wt. (kN)	Max/Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)	ACN/ALR for Flexible Pavements for Subgrade Bearing Strength – S (kN)
DC-6	480	300	44.0	0.73	78.0	30/7.57
	300					17/5.50
	640					46/9.10
	400					27/7.08
DC-7	400	400	47.5	0.89	76.2	42/9.19
	640					36/9.24
	400					20/7.10
	19/----					13/----
DC-8-62	1593	800	47.5	1.35	81.3	65/11.03
	800					24/7.71
	480					21/7.80
	20/----					15/----
DC-9-21	445	300	47.5	1.02	61.0	30/8.07
	300					18/6.56
	445					26/8.27
	25/----					15/----
DC-10-10	2037	1035	47.5	1.34	137.2	93/11.03
	1035					27/7.34
	53/10.74					57/10.68
	23/9.17					24/8.27
DC-10-30	2593	1220	39	1.22	137.2	99/11.33
	1220					32/7.21
	55/10.76					72/11.04
	22/8.92					23/8.08
DHC7 Dash 7	209	120	46.8	0.74	42.0	15/5.40
	120					13/5.43
	10/----					12/----
	5/----					7/----
Dornier 328 Jet	155	93	46.4	1.13	41.0	11/4.84
	93					10/5.35
	8/----					8/----
	4/----					5/----
Fokker F27 Friendship	205	120	47.5	0.57	45.0	14/5.16
	120					13/4.74
	9/----					11/----
	5/----					6/----
Fokker F28 Fellowship	325	175	47.5	0.53	55.0	23/6.78
	175					20/6.30
	14/----					17/----
	6/----					9/----
Gulfstream G159	156	100	47.5	0.83	42.0	11/4.60
	100					10/4.75
	8/----					8/----
	4/----					5/----
Gulfstream V	405	215	47.5	1.37	46.0	31/7.65
	215					30/8.25
	26/9.20					28/8.70
	12/----					13/6.88
HS/Bae 125-600	112	61	47.5	0.83	32.0	8/4.01
	61					7/----
	6/----					3/----
	3/----					11/----
HS/Bae 748	227	120	47.5	0.51	48.0	16/5.44
	120					14/4.79
	9/----					5/----
	4/----					7/3.07

TABLE 6: ACN/ALR COMPARISON FOR FLEXIBLE PAVEMENTS (PAGE 4 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Flexible Pavements for Subgrade Bearing Strength – S (kN)			
				Dual	Tandem	50	90	130	180
L-1011-500 Tristar	2295	47.6	1.35	132.1	177.8	107/11.64	79/11.47	67/11.43	61/11.21
	1070					35/7.55	28/7.51	25/8.36	24/9.26
MD-11	2805	39.0	1.38	137.2	162.6	110/11.64	82/11.43	68/11.35	62/11.08
	1200					31/7.05	25/7.22	23/8.19	22/9.10
Saab 2000	226	47.5	0.69	46.0	----	16/5.57	14/5.50	13/----	11/----
	136					9/3.86	7/----	7/----	6/----
Shorts 360	121	47.5	0.54	----	----	11/4.03	10/----	9/----	7/----
	77					7/2.99	7/----	6/----	5/----

Aircraft Model	Wt. (kN) Max/Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)	ACN/ALR for Rigid Pavements for Bearing Modulus - k (MPa/m)
Airbus A300-B4-200	1627 1236	46.97	1.28	90.2	75/10.73 51/9.54 66/10.74 56/10.66 46/10.44
Airbus A310-200	1509 800	46.6	1.46	92.7	67/10.41 59/10.42 51/10.34 43/10.14
Airbus A321-200	877 461	47.46	1.46	92.7	64/10.24 62/10.54 59/10.85 56/11.13
Airbus A330-200	2264 1650	47.5	1.42	139.7	85/11.16 73/11.10 61/11.01 53/10.98
Airbus A340-600	3590 1750	33.0	1.42	140	97/11.57 83/11.52 70/11.45 60/11.41
A380-800	5514 2758	28.5	1.47	153 170	110/11.96 88/11.69 67/11.33 55/11.05
Antonov AN-124-100	3844 2000	47.5	1.03	99.5 165	100/11.63 73/11.04 48/10.15 35/9.28
Antonov AN-225	5884 4500	47.5	1.13	87 175	125/12.34 89/11.70 61/10.95 45/10.20
BI-B Bomber	2123 1400	47.5	1.65	85	113/12.03 102/12.14 89/12.24 77/12.28
BAC-111 Series 500	467 250	47.5	1.10	51.8	36/8.31 35/8.55 34/8.79 33/8.97
B707-120	1150 700	47.0	1.17	86	47/9.20 40/9.10 34/8.86 28/8.54
B707-320	1484 800	47.5	1.24	86.0	67/10.40 59/10.40 50/10.29 42/10.03
B720	1045 700	47.8	1.01	86.0	41/8.76 35/8.58 29/8.26 24/7.88
B727-200 Standard	770 450	47.5	1.15	86.4	54/9.69 52/9.95 50/10.20 47/10.39
				----	29/7.64 28/7.78 26/7.89 24/7.95

TABLE 7: ACN/ALR COMPARISON FOR RIGID PAVEMENTS (PAGE 1 OF 4)

TABLE 7: ACN/ALR COMPARISON FOR RIGID PAVEMENTS (PAGE 2 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Rigid Pavements for Bearing Modulus – k (MPa/m)			
				Dual	Tandem	20	40	80	150
B727-200 Advanced	934	47.5	1.19	86.4	----	69/10.42	66/10.72	63/11.02	59/11.28
	450					29/7.66	28/7.81	26/7.93	25/8.00
B737-100	445	47.5	1.02	77.5	----	29/7.64	28/7.78	26/7.88	25/7.93
	260					16/5.62	15/5.61	14/5.53	13/5.53
B737-200	572	47.5	1.26	77.5	----	41/8.74	39/8.98	37/9.20	35/9.35
	300					19/6.29	19/6.35	18/6.38	16/6.42
B747-100 SR	2690	23.8	1.04	111.8	147.3	50/9.46	42/9.29	35/8.99	29/8.67
	1600					25/7.09	21/6.79	18/6.46	16/6.33
B747-200	3720	23.8	1.38	111.8	147.3	82/11.05	72/11.04	61/10.96	51/10.78
	1750					30/7.71	26/7.51	22/7.27	20/7.17
B747-400	3905	23.8	1.38	111.8	147.3	88/11.25	77/11.26	65/11.19	54/11.03
	1800					31/7.84	27/7.64	23/7.40	20/7.29
B757-200	1134	47.5	1.24	86.4	114.3	52/9.54	45/9.50	38/9.34	32/9.03
	570					20/6.46	18/6.18	15/5.80	13/5.57
B767-200	1410	47.5	1.31	114.3	142.2	56/9.83	48/9.74	41/9.55	34/9.32
	800					26/7.28	22/7.05	19/6.79	18/6.71
B777-200 LR	3345	46.9	1.50	139.7	144.8	129/12.47	107/12.28	84/12.01	64/11.66
	1424			Six Wheel Gear		36/8.33	29/7.91	24/7.55	24/7.50
B777-300	2945	47.4	1.48	139.7	144.8	108/11.90	89/11.70	69/11.38	54/11.00
	1562			Six Wheel Gear		42/8.84	33/8.43	27/8.04	20/7.92
Convair 990	1135	48.5	1.28	61.0	118.0	60/10.02	54/10.09	47/10.07	40/9.89
	600					26/7.21	23/7.04	19/6.74	17/6.44
Dassault Falcon 900	202	47.5	1.30	42.0	----	15/5.48	15/5.55	14/5.58	14/5.69
	103					7/----	7/----	7/----	6/----
DC-3	147	46.8	0.31	----	----	9/4.05	9/----	8/----	8/----
	80					5/----	5/----	5/----	4/----
DC-4	335	46.8	0.53	74.0	----	19/6.08	17/6.01	16/5.84	14/5.65
	200					10/4.24	9/4.03	8/----	7/----

TABLE 7: ACN/ALR COMPARISON FOR RIGID PAVEMENTS (PAGE 3 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Rigid Pavements for Bearing Modulus – k (MPa/m)			
				Dual	Tandem	20	40	80	150
DC-6	480	44.0	0.73	78.0	----	27/7.39	26/7.47	24/7.48	22/7.42
	300					16/5.62	15/5.57	14/5.42	12/5.33
DC-7	640	47.5	0.89	76.2	----	44/8.96	42/9.17	40/9.35	37/9.44
	400					26/7.16	24/7.25	23/7.29	21/7.28
DC-8-62	1593	47.5	1.35	81.3	139.7	77/10.84	69/10.89	59/10.86	50/10.69
	800					31/7.81	27/7.63	23/7.36	20/7.14
DC-9-21	445	47.5	1.02	61.0	----	32/7.91	31/8.10	29/8.27	28/8.37
	300					20/6.41	19/6.49	18/6.53	17/6.56
DC-10-10	2037	47.5	1.34	137.2	162.6	80/10.99	69/10.92	58/10.80	49/10.67
	1035					32/7.99	28/7.80	24/7.65	23/7.67
DC-10-30	2593	39	1.22	137.2	162.6	84/11.12	72/11.04	59/10.89	50/10.71
	1220					30/7.77	26/7.55	23/7.37	21/7.39
DHC7 Dash 7	209	46.8	0.74	42.0	----	14/5.23	14/5.23	13/5.16	12/5.17
	120					8/----	7/----	7/----	6/----
Dornier 328 Jet	155	46.4	1.13	41.0	----	11/4.43	10/4.39	10/----	10/----
	93					6/----	6/----	6/----	5/----
Fokker F27 Friendship	205	47.5	0.57	45.0	----	13/4.98	13/4.92	12/4.77	11/----
	120					7/----	7/----	6/----	6/----
Fokker F28 Fellowship	325	47.5	0.53	55.0	----	21/6.38	20/6.39	18/6.32	16/6.21
	175					10/4.18	9/----	9/----	8/----
Gulfstream G159	156	47.5	0.83	42.0	----	11/4.34	10/4.27	10/----	9/----
	100					6/----	6/----	6/----	5/----
Gulfstream V	405	47.5	1.37	46.0	----	33/8.01	32/8.27	32/8.53	31/8.75
	215					16/5.64	16/5.72	15/5.77	14/5.88
HS/BAe 125-600	112	47.5	0.83	32.0	----	8/----	8/----	7/----	7/----
	61					4/----	4/----	4/----	3/----
HS/BAe 748	227	47.5	0.51	48.0	----	14/5.20	13/5.13	12/4.97	11/----
	120					7/----	6/----	6/----	5/----

TABLE 7: ACN/ALR COMPARISON FOR RIGID PAVEMENTS (PAGE 4 OF 4)

Aircraft Model	Wt. (kN) Max/ Min	% Load on Gear	Tire Press. (MPa)	Wheel Spacing (cm)		ACN/ALR for Rigid Pavements for Bearing Modulus – k (MPa/m)			
				Dual	Tandem	20	40	80	150
L-1011-500 Tristar	2295	47.6	1.35	132.1	177.8	93/11.44	80/11.39	67/11.29	56/11.18
	1070					33/8.08	29/7.90	25/7.77	24/7.80
MD-11	2805	39.0	1.38	137.2	162.6	96/11.53	83/11.49	69/11.41	58/11.30
	1200					30/7.80	26/7.61	23/7.47	22/7.51
Saab 2000	226	47.5	0.69	46.0	----	15/5.42	15/5.42	14/5.35	13/5.32
	136					8/----	8/----	7/----	7/----
Shorts 360	121	47.5	0.54	----	----	9/4.06	9/4.03	9/----	9/----
	77					6/----	6/----	6/----	6/----

TABLE 8: PLR TO PCN CONVERSIONS FOR FLEXIBLE AND RIGID PAVEMENTS

Flexible Pavements				
Canadian PLR Value	ICAO Subgrade Strength Category Code Letter			
	Flexible Pavement Subgrade Strength – S (kN) – Range and Nominal Value			
	A (High) >160 180	B (Medium) 160 - 110 130	C (Low) 110 - 70 90	D (Ultra Low) <70 50
Equivalent ICAO Pavement Classification Number (PCN)				
2	-----	4		
3	-----	6		
4	-----	9		
5	----- 12	13		
6	----- 16	19		
7	----- 16 21	27		
8	----- 23 29 37	24 32 39 50		
9	38 43 51	64		
10	53 57 66	81		
11	68 72 83	101		
12	80 88 103	124		
13				
For Category A: $PCN = 100.000 - (46.9401 * PLR) + (6.0420 * PLR^2) - (0.1963 * PLR^3)$ For Category B: $PCN = 75.0000 - (24.7528 * PLR) + (2.7623 * PLR^2) - (0.0603 * PLR^3)$ For Category C: $PCN = 15.0000 - (3.7769 * PLR) + (0.5096 * PLR^2) + (0.0230 * PLR^3)$ For Category D: $PCN = 5.0000 - (1.3799 * PLR) + (0.4657 * PLR^2) + (0.0264 * PLR^3)$				
Rigid Pavements				
Canadian PLR Value	ICAO Subgrade Strength Category Code Letter			
	Rigid Pavement Bearing Modulus – k (MPa/m) – Range and Nominal Value			
	A (High) >120 150	B (Medium) 120 - 60 80	C (Low) 60 - 25 40	D (Ultra Low) <25 20
Equivalent ICAO Pavement Classification Number (PCN)				
4	----	----	8	9
5	11	12	13	14
6	15	16	17	18
7	19	21	22	24
8	25	27	29	32
9	32	35	39	44
10	42	46	53	60
11	54	62	72	82
12	70	82	97	111
13	91	108	130	148
For Category A: $PCN = - 25.5382 + (13.3710 * PLR) - (1.7555 * PLR^2) + (0.1090 * PLR^3)$ For Category B: $PCN = - 32.6516 + (17.4785 * PLR) - (2.4529 * PLR^2) + (0.1495 * PLR^3)$ For Category C: $PCN = - 40.9244 + (21.9479 * PLR) - (3.1986 * PLR^2) + (0.1939 * PLR^3)$ For Category D: $PCN = - 30.0000 + (17.9684 * PLR) - (2.7926 * PLR^2) + (0.1894 * PLR^3)$				

TABLE 9: EXAMPLE PLR TO PCN CONVERSIONS

Flexible Pavements	
Given:	A flexible pavement system having a subgrade strength "S" of 60 kN and a pavement equivalent granular thickness "t" of 100 cm (i.e. a strength code of S60t100). The asphalt thickness is 8.5 cm, the base course thickness is 20 cm, and the sub-base course thickness is 63 cm.
Solution:	Plot the strength code parameters $S = 60$ kN and $t = 100$ cm on Figure 1. The PLR is taken as the value of the standard PLR curve lying immediately above the plotted point – in this case, the PLR is 9. Using Table 2 with an asphalt thickness of 8.5 cm and a base course thickness of 20 cm, the tire pressure restriction is 1.0 MPa. The PLR code is 9 (1.0 MPa).
	Using Table 8, the PLR value can be converted to an equivalent PCN value of 50 for a Code D (Ultra-Low) strength subgrade. The resulting ICAO PCN code is: 50/F/D/1.0MPa/T where "F" indicates a flexible pavement system, "D" an Ultra-Low strength subgrade and "T" indicates that the code has been derived based on a technical evaluation. It is preferable to state the actual tire pressure limitation in MPa rather than use the ICAO tire pressure code letters except that where there is no tire pressure limit, the code letter "W" should be used.
Rigid Pavements	
Given:	A rigid pavement system having a bearing modulus strength "k" of 100 MPa/m and a concrete slab thickness "h" of 30 cm (i.e. a strength code of k100h30).
Solution:	Plot the strength code parameters $k = 100$ MPa/m and $h = 30$ cm on Figure 2. The PLR is taken as the value of the standard PLR curve lying immediately above the plotted point – in this case, the PLR is 11. Tire pressure restrictions need not be applied to rigid pavement systems. The PLR Code is 11.
	Using Table 8, the PLR value can be converted to an equivalent PCN value of 62 for a Code B (Medium) strength bearing modulus. The resulting ICAO PCN Code is: 62/R/B/W/T where "R" indicates a rigid pavement system, "B" a Medium strength subgrade, "W" that there is no tire pressure limitation and "T" that the code has been derived based on a technical evaluation.
Gravel Surfaced Pavements	
Given:	A flexible pavement system having a subgrade strength of "S" = 60 kN and a pavement equivalent granular thickness "t" of 100 cm (i.e. a strength code of S60t100). The surface is of gravel construction and the tire pressure restriction has been assessed to be 0.69 MPa.
Solution:	Plot the strength code parameters $S = 60$ kN and $t = 100$ cm on Figure 1. The PLR is taken as the value of the standard PLR curve lying immediately above the plotted point – in this case, the PLR is 9. The PLR Code is 9 (0.69 MPa).
	The PCN code is determined as described for flexible pavements above except that the gravel surface tire pressure limitation is used. As illustrated in the examples of Table 5, a note should be appended to the PCN code to indicate that the surface is gravel. The ICAO PCN Code is: 50/F/D/0.69 MPa/T Note: Gravel Surface Construction.

FIGURE 1: FLEXIBLE PAVEMENT DESIGN CURVES FOR STANDARD GEAR LOADING

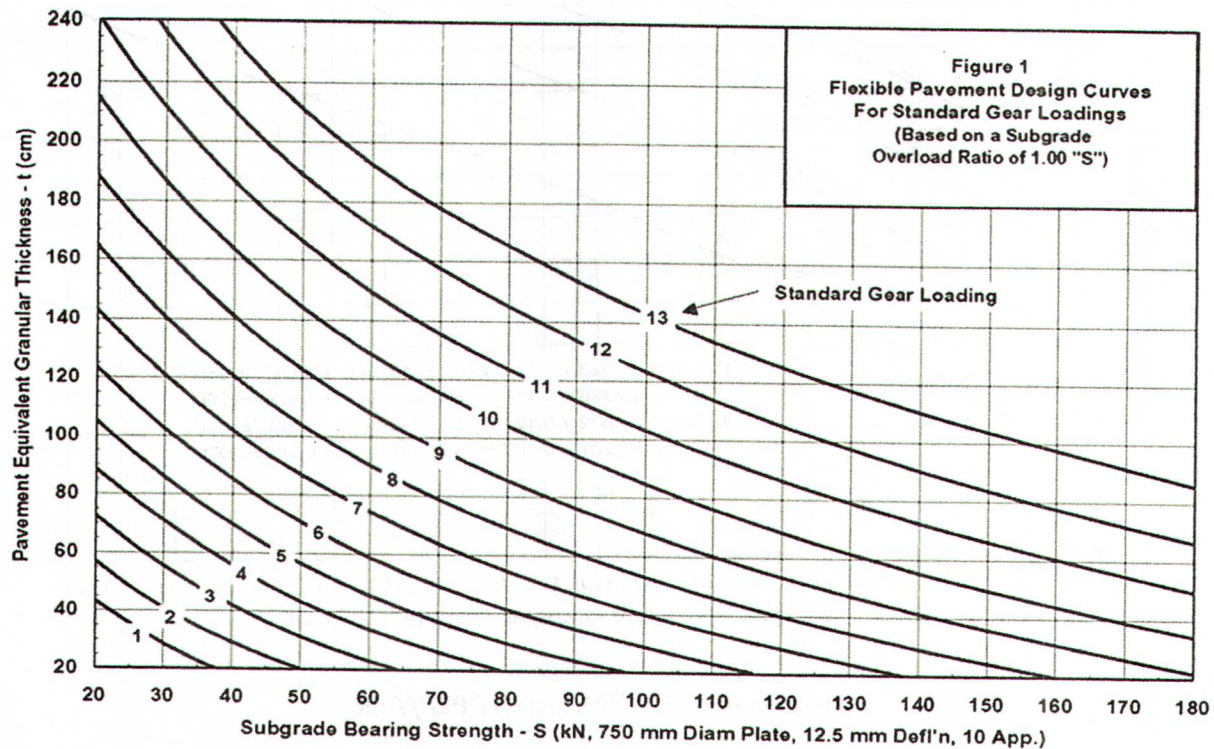


FIGURE 2: RIGID PAVEMENT DESIGN CURVES FOR STANDARD GEAR LOADINGS

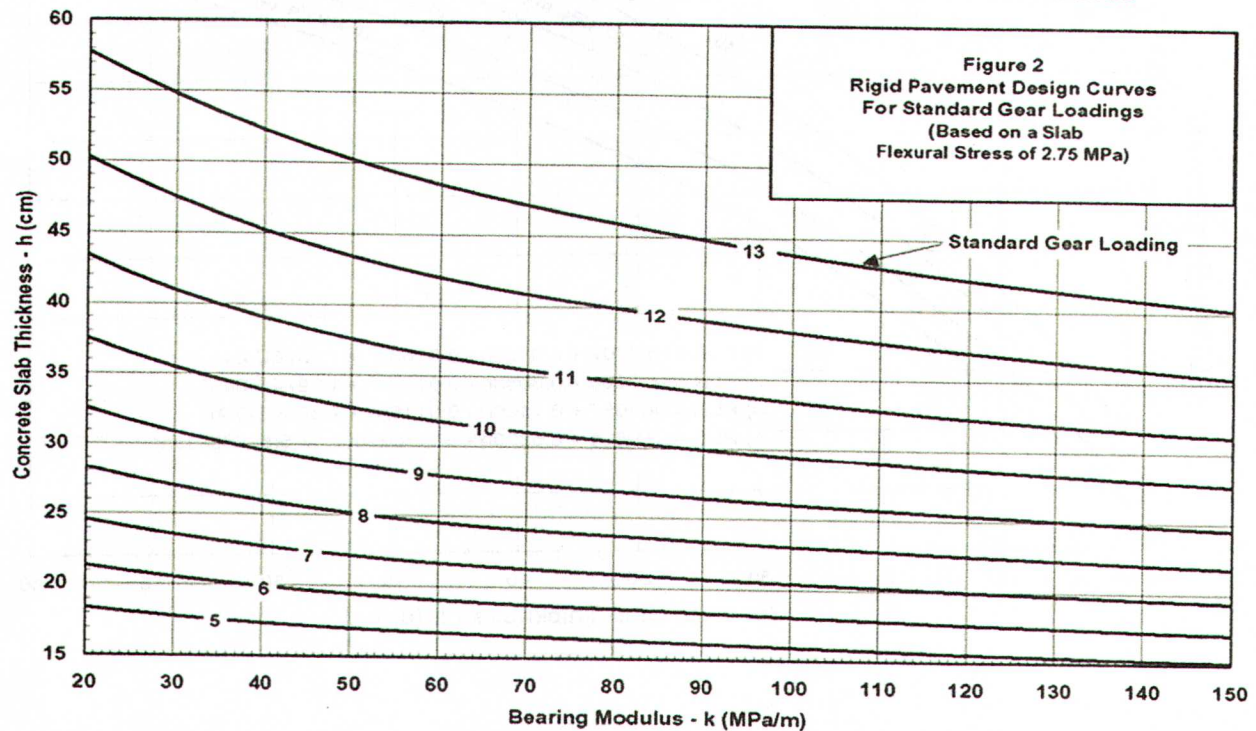


FIGURE 3: FLEXIBLE PAVEMENT PLR/ALR

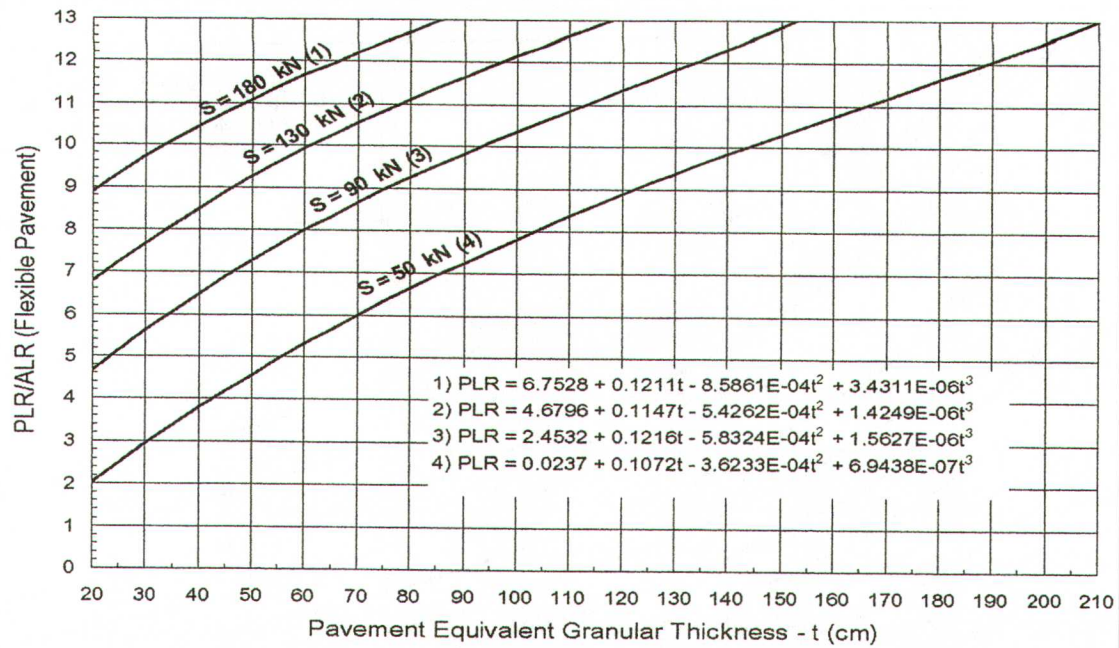


FIGURE 4: RIGID PAVEMENT PLR/ALR

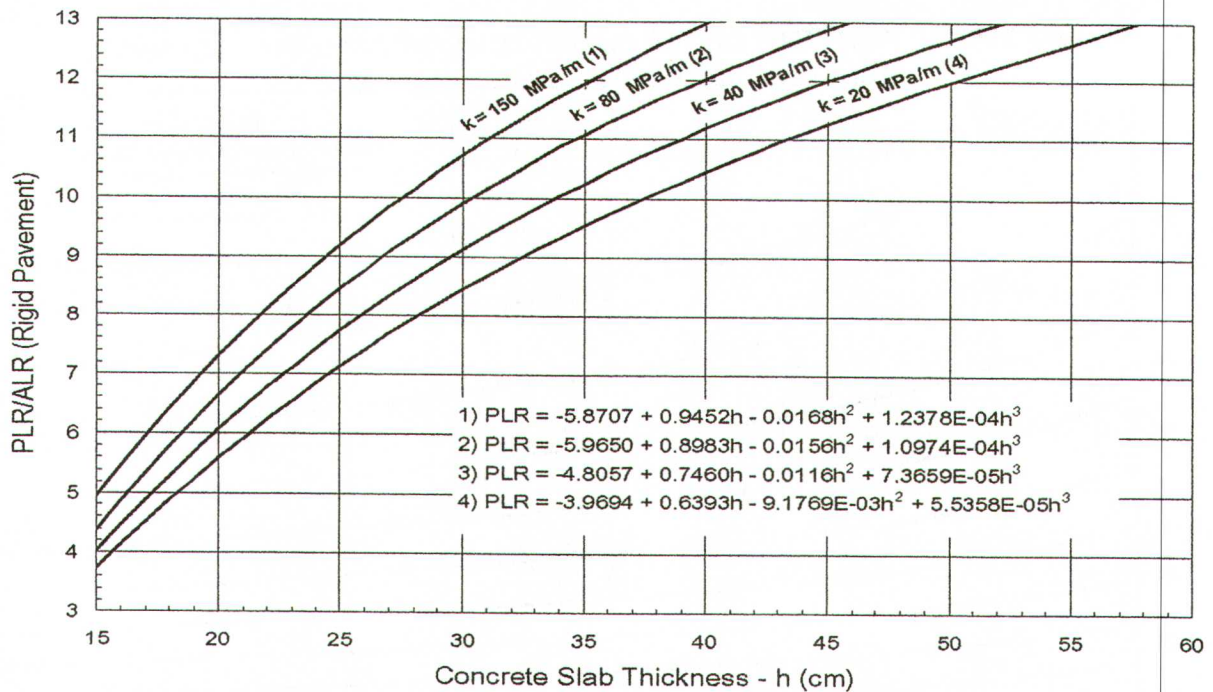


FIGURE 5: RIGID PAVEMENT BEARING MODULUS (K) ON TOP OF BASE

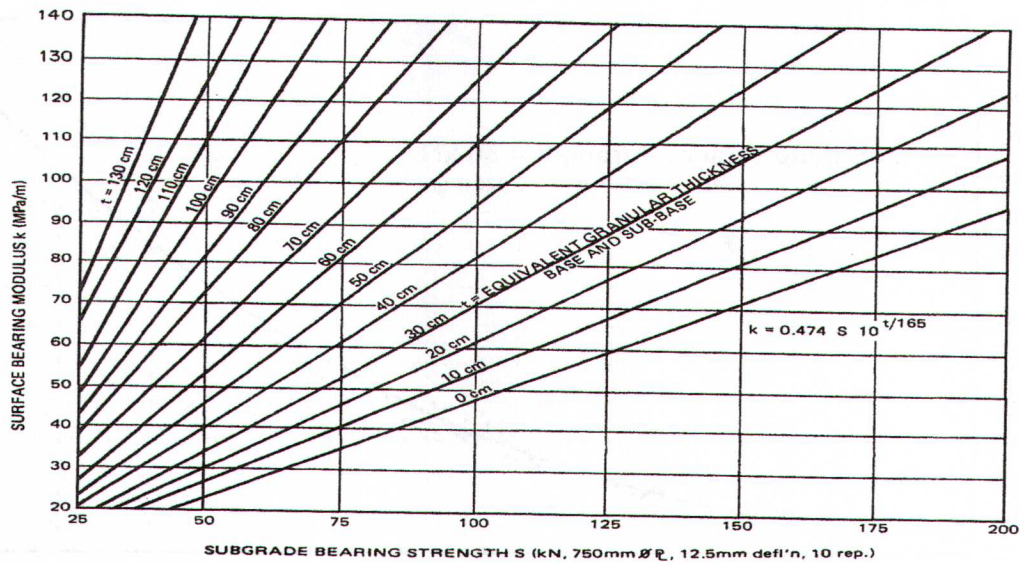


FIGURE 6: EQUIVALENT SINGLE SLAB THICKNESS OF OVERLAID CONCRETE SLAB

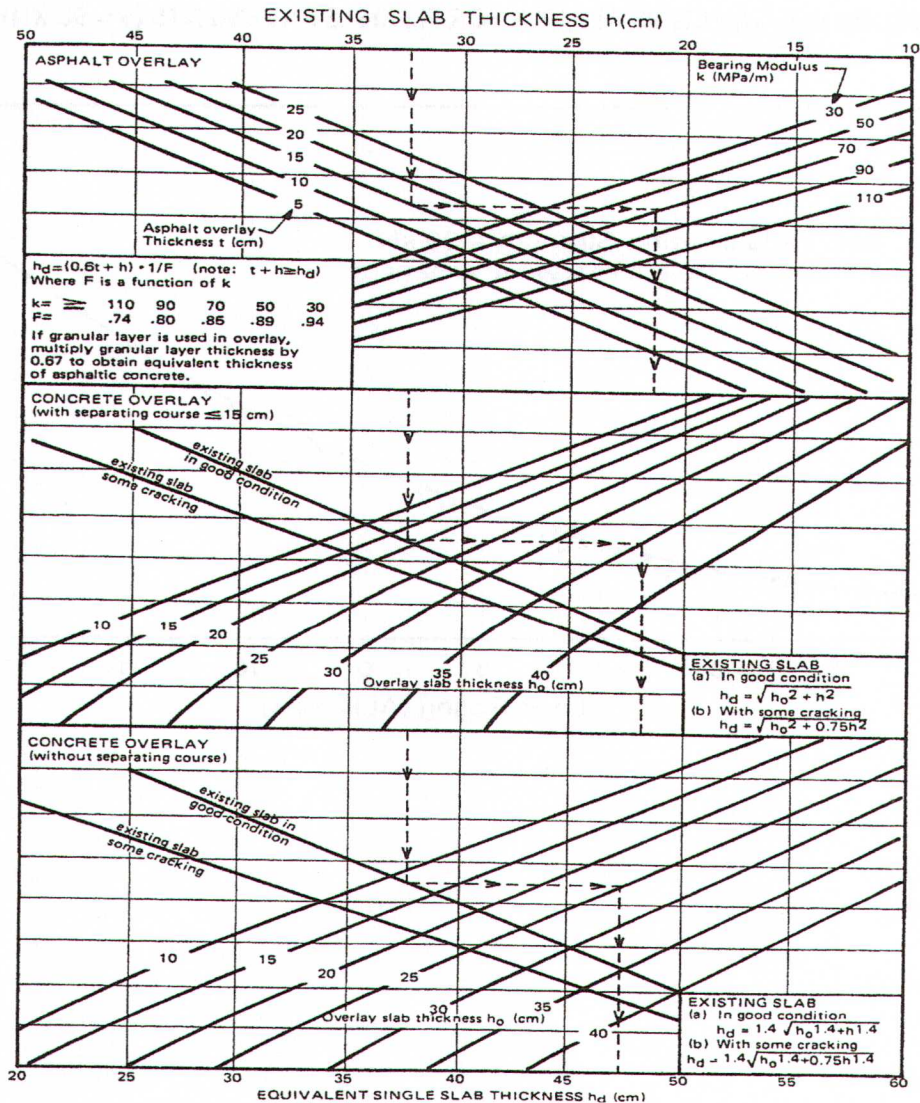


FIGURE 7: ACN/PCN VS ALR/PLR FOR FLEXIBLE PAVEMENTS (S = 50 kN)

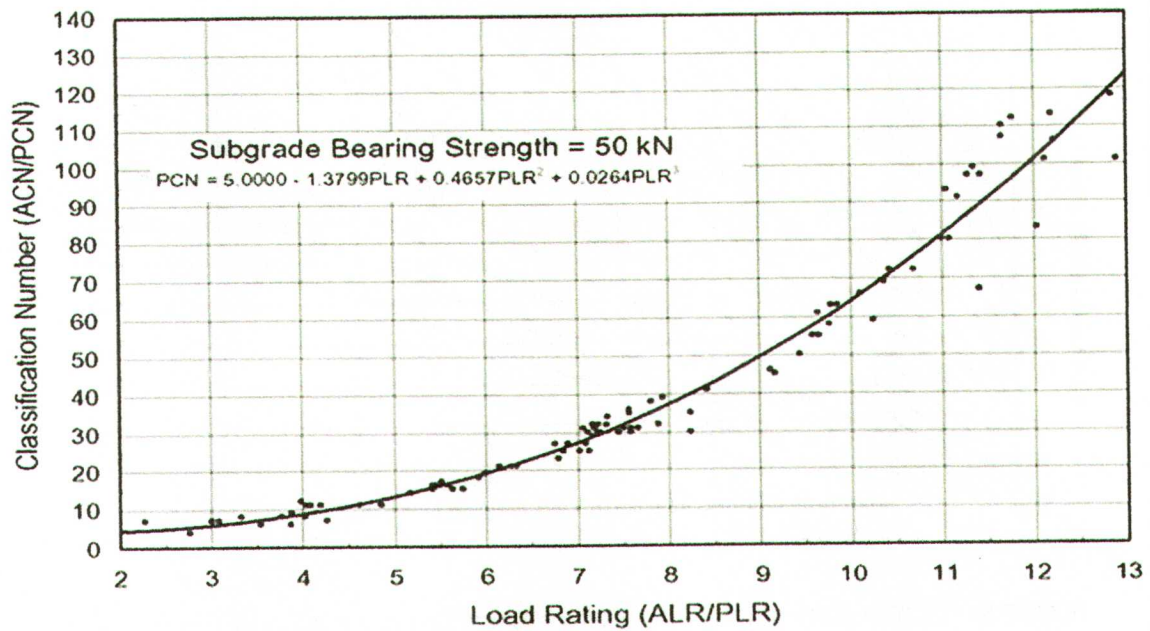


FIGURE 8: ACN/PCN VS ALR/PLR FOR FLEXIBLE PAVEMENTS (S = 90 kN)

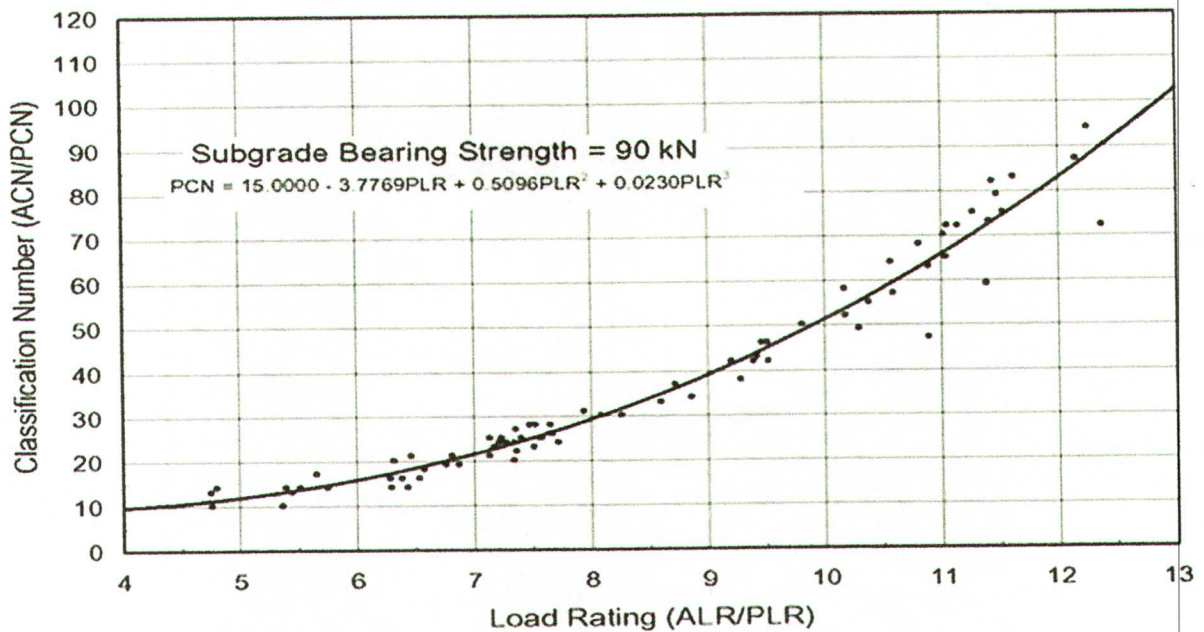


FIGURE 9: ACN/PCN FOR FLEXIBLE PAVEMENTS (S = 130 kN)

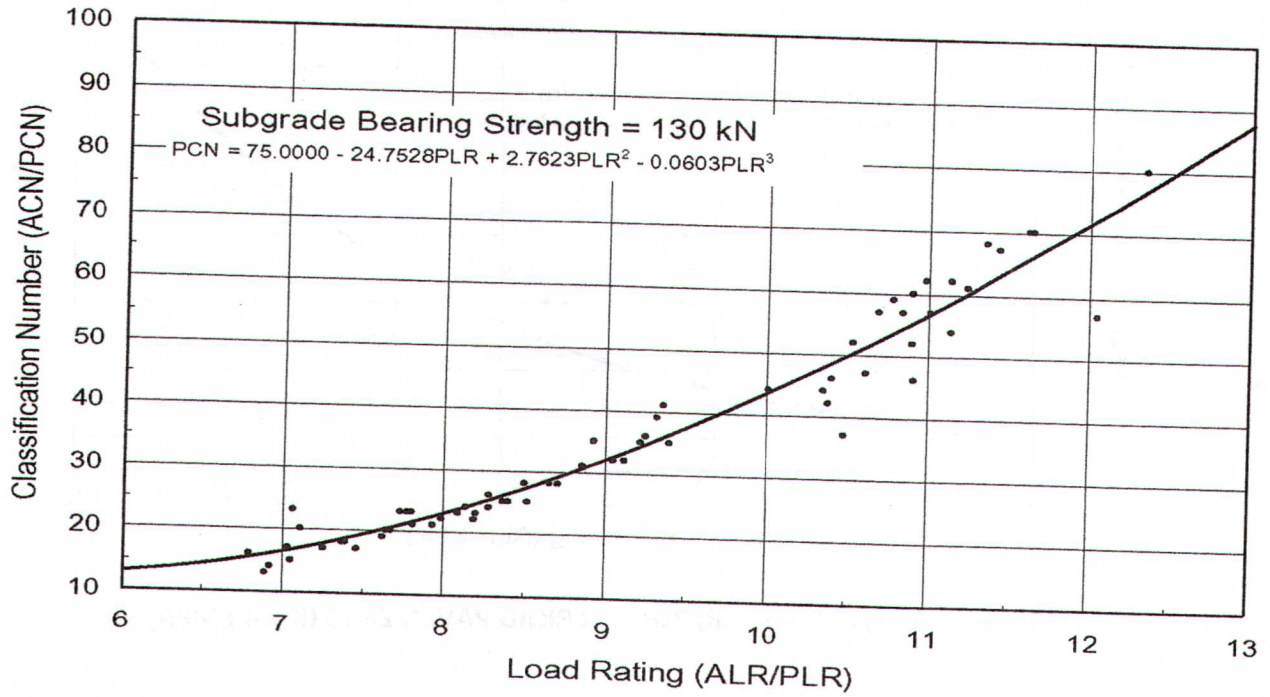


FIGURE 10: ACN/PCN VS ALR/PLR FOR FLEXIBLE PAVEMENTS (S = 180 kN)

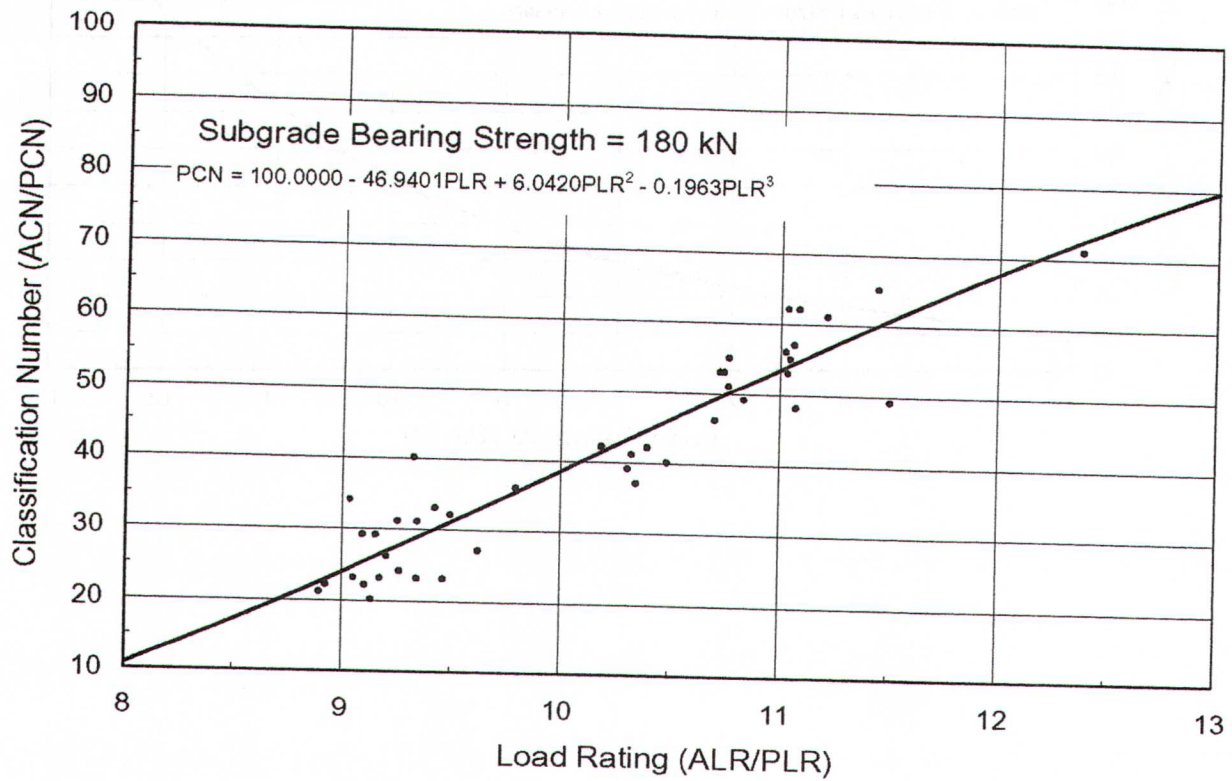


FIGURE 11: ACN/PCN VS ALR/PLR FOR RIGID PAVEMENTS (K = 20 MPA/M)

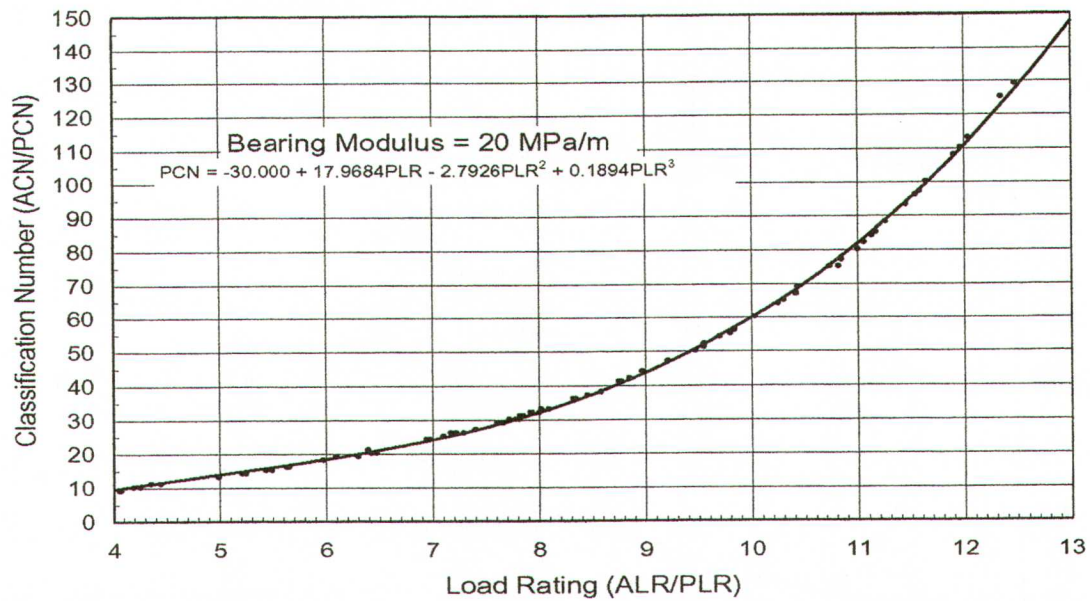


FIGURE 12: ACN/PCN VS ALR/PLR FOR RIGID PAVEMENTS (K = 40 MPA/M)

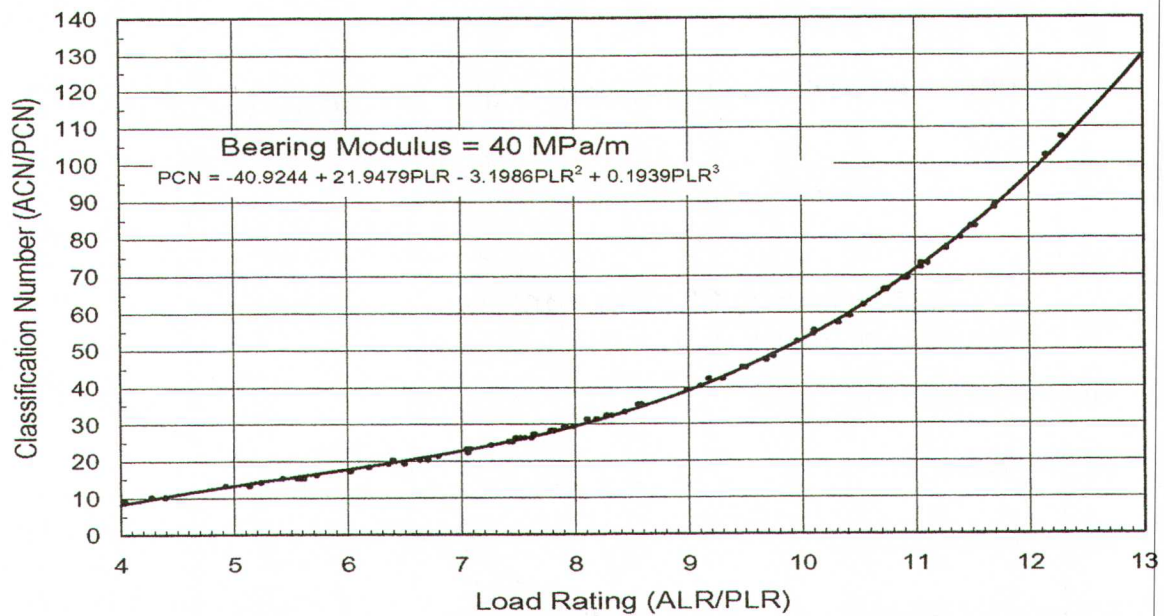


FIGURE 13: ACN/PCN VS ALR/PLR FOR RIGID PAVEMENTS (K = 80 MPa/M)

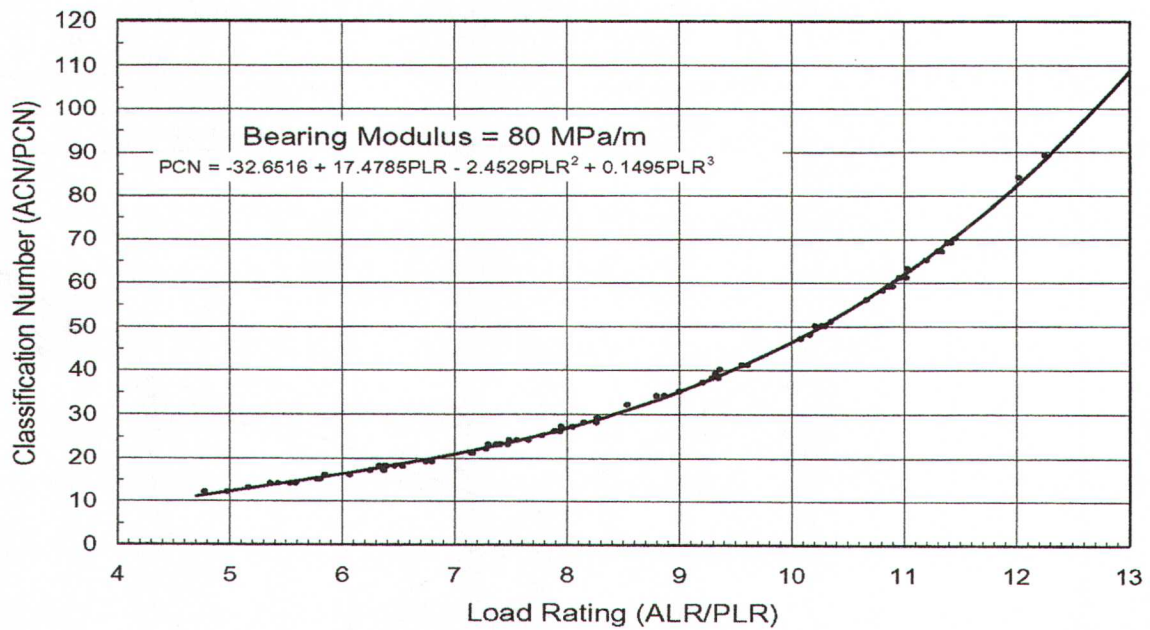


FIGURE 14: ACN/PCN VS ALR/PLR FOR RIGID PAVEMENTS (K = 150 MPa/M)

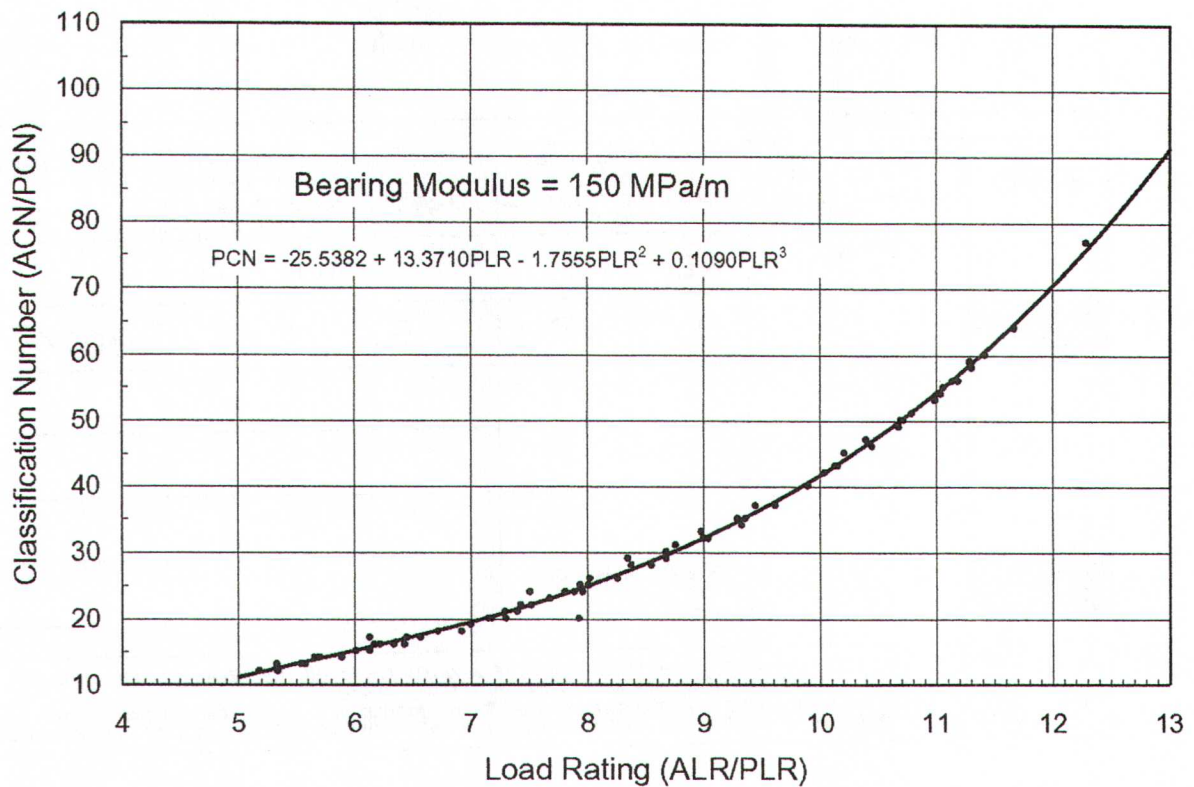
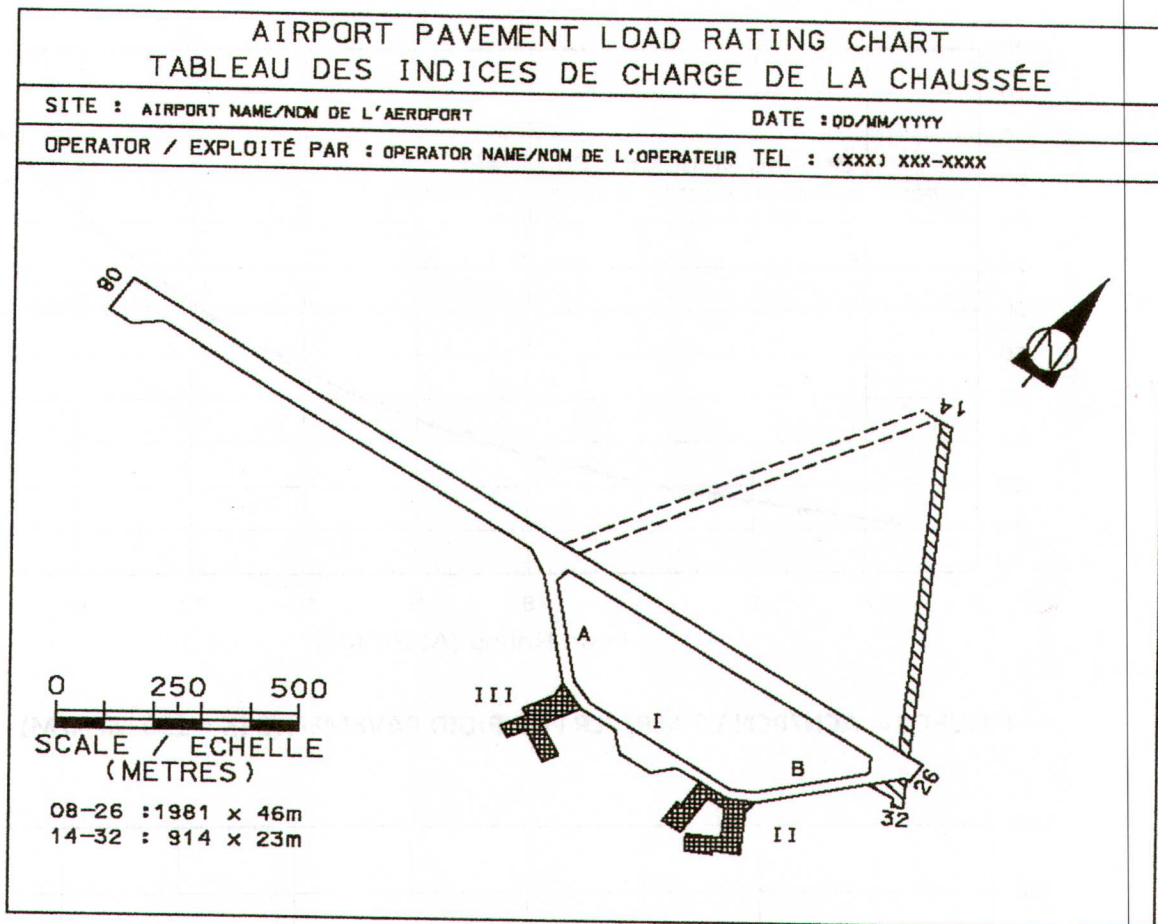


FIGURE 15: AIRPORT PAVEMENT LOAD RATING CHART



SECTION	PAVEMENT LOAD RATING (PLR) INDICE DE CHARGE DE LA CHAUSSEE	TIRE PRESSURE LIMIT LIMITE DE PRESSION PNEU	ICAO PAVEMENT CLASSIFICATION NUMBER (PCN) CODE NUMÉRO DE CLASSIFICATION DE LA CHAUSSEE (PCN) DE L'OACI
	9	NO LIMIT	50/F/D/W/T
	3	0.5 MPa	6/F/D/0.5MPa/T
	NOT NON	EVALUATED EVALUE	

NOTE: SPECIFIC AUTHORIZATION MUST BE OBTAINED FROM THE AIRPORT OPERATOR FOR OPERATION OF AIRCRAFT WITH LOAD RATINGS OR TIRE PRESSURES EXCEEDING THE VALUES SHOWN.

NOTE: UNE AUTORISATION SPÉCIFIQUE D'EXPLOITATION DOIT ÊTRE OBTENUE DES AUTORITÉS AÉROPORTUAIRES POUR UTILISATION D'AÉRONEUF DONT LE POIDS OU LA PRESSION DES PNEUS DÉPASSENT LES LIMITES INDICÉES.