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STRUCTURAL MAINTENANCE OF AIRFIELDS – CALCULATION AND EVALUATION OF THE PAVEMENT CLASSIFICATION NUMBER (PCN) ON THE BASIS OF DYNAMIC MEASUREMENTS OF THE LOAD CARRYING CAPACITY

B. Grätz
Dr.-Ing., Institute of Traffic and Transport, Section Road and Pavement Engineering
Technical University of Darmstadt
Petersenstraße 30
64287 Darmstadt, Germany
graetz@verkehr.tu-darmstadt.de

St. Riedl
Dr.-Ing., Institute of Transportation Section Engineering and Maintenance of Roads and Pavements
University of Kassel, Mönchebergstraße 7
34125 Kassel, Germany
sriedl@uni-kassel.de
ABSTRACT

The basis for the structural design of flexible (asphalt) pavements of airfields is described by the ICAO-Method. With this method the PCN (Pavement Classification Number) is calculated and evaluated. A high PCN value corresponds to a high load-carrying capacity of the pavement structure. As input sizes the CBR-value (Californian Bearing Ration) of the subgrade and the thickness of the upper pavement structure are necessary. The evaluation of the load-carrying capacity of the pavement structure of a regional airport should be carried out on the basis of the ICAO-Method with data, measured with the Falling Weight Deflectometer (FWD). The evaluation procedure and the appraisal procedure on the basis of a structural-model and the ICAO-Method are described in this publication. From the investigations it is concluded that with the ICAO method no assessment and state evaluation can be executed. However, the assessment, survey and state evaluation can be executed on the basis of the structural-model described in this article. In this evaluation method the thickness and the layer-modulus of the bound upper pavement structure as well as the layer-modulus of the unbound layers are implemented.

KEY WORDS

Airfield, maintenance, Falling Weight Deflectometer, FWD, pavement, surveying, structure, structural design, ICAO
INTRODUCTION

Since the beginning of the intensified use of jet aircraft with high weights and high tire pressures, the accurate comparison between airplane load effects and the load-carrying capacity of the airfields became a necessity. In different countries, several methods for the determination of the load effects of undercarriages were developed. In the year 1962, the International Civil Aviation Organization (ICAO) transferred two of these techniques. Ten years later, there were already four techniques for the specification of the load-carrying capacity of airfields, recognized by the ICAO. In the middle of the 60's, the complicated computing procedures and the defective reproducibility between the different specification techniques already led to the demand for a uniform method for calculating and publishing the load-carrying capacity of airfields. In efforts of many years, a specialized committee on behalf of the ICAO processed the ACN/PCN method (1):

- **ACN** = Aircraft Classification Number
- **PCN** = Pavement Classification Number

The ACN/PCN method was assumed 1980 as aviation standard for the world-wide uniform specification of the load effects of airplanes and the specification of the load-carrying capacity of airfields in the member states. It is fixed and since 1981 valid in the appendix 14 to the ICAO convention (2).

PROBLEM DEFINITION AND OBJECTIVE

The ACN/PCN method uses simple pavement models for determining the airplane load effects (ACN) and the load-carrying capacities (PCN) of airfields. Therefore, some material indices were standardized. The comparison of the load-carrying capacity of the pavement and the airplane load effect manufactured by calculation of the maximum admissible load per unit area in one by the construction of the coating defined depth of the carrying system and by calculation of the load per unit area in this depth, caused by the airplane. The characteristic load factors are converted into surface equivalent loads with more uniformly (more standardized) surface pressure. For extremely different load-carrying capacity values, due to seasonal influences of the weather (frost, thaw, groundwater etc.), several load-carrying capacity specifications can be published. The computation methods presuppose that the traffic load (inclusive impulse-factors) works statically. Two computation methods can be differentiated (1):

- flexible pavements (constructions with bituminous layers)
- rigid pavements (constructions with concrete layers)

The system for calculating the airplane load effects of flexible pavements corresponds to the one layer model defined by Boussinesq as homogeneous, isotropic half-space. The equivalent circular load area for the airplane, which causes effects in the pavement system equal to the undercarriage, depends thereafter on the airplane load characteristic values, the poisson’s-ratio of the medium and on the regarded point of depth of the medium. The poisson’s-ratio is set with a default value $\mu = 0.5$. With the help of the calculation of the load-carrying capacity of the pavement for four load-carrying capacity categories, four points of depth are determined. The load-carrying capacity of the flexible pavement system is calculated with the
help of (the mainly empirical determined) CBR-formula, which contains as characteristic parameters the pavement thickness and the load-carrying capacity (CBR) of the unbound layers. According to the authors of the ACN/PCN method the different methods for calculating the load per unit area in the depth of a flexible pavement (the one layer-system according to Boussinesq and the two layer-systems according to the CBR-method) can be treated equal (1).

For rigid pavements the airplane load effects and the load-carrying capacity of the pavement are calculated according to the two-layer-system evaluated by Westergaard. According to this method the effects in the depth of the pavement system are dependent on the airplane load characteristic values, the Young's modulus, the poisson's-ratio and the certified bending tensile stress of the concrete as well as on the load carrying capacity of the subgrade k. For all pavement characteristic values, default values are used (for the load carrying capacity of the subgrade four categories). The airplane load effect is converted into the equivalent circular area load at the pavement surface (1).

Network and special pavements are classified depending upon their characteristic system performance as flexible or rigid pavements and calculated according to (1).

The ACN/PCN method evaluates the load-carrying capacity according to the principle that the available stress may be smaller or achieve the admissible stress or strength which can be expressed by the following relation:

\[ \text{ACN} \leq \text{PCN} \]

The flexible pavement consists of bituminous bound layers and several further load-distributing layers (2). For the calculation of the PCN only the thickness of the pavement (bituminous bound layers) as well as the CBR-value is needed. The calculation is identical to the calculation of the ACN value, as the PCN value from a derived single wheel load (DSWL) is determined. In order to ensure the reproducibility with the ACN, the CBR-value is standardized. As pavement thickness the really available pavement thickness is set. With the PCN calculation it is sufficient in contrast to the ACN calculation to intend the CBR-value for the available subgrade-category. The PCN is calculated directly from the pavement thickness and the standardized CBR-value (3), (4), (5):

\[ \text{PCN} = \frac{h_{\text{available}}^2}{0.878 \frac{1}{CBR_{ST}} - 0.01249} = \frac{h_{\text{available}}^2}{0.878 \frac{1}{CBR_{ST}} - 12.49} \]

with:
- \( \text{PCN} \) = Pavement Classification Number
- \( h_{\text{available}} \) = available pavement thickness in cm
- \( CBR_{ST} \) = subgrade standard factor in CBR-%
For the calculation of the PCN the subgrade is divided into four standard-categories that are presented in Table 1.

### Table 1
**Classification of the CBR-value in the ACN/PCN technique for flexible pavements according to (4)**

<table>
<thead>
<tr>
<th>Load-carrying capacity</th>
<th>effective background factor [CBR-%]</th>
<th>standardized subgrade factor [CBRSt-%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>CBR &gt; 13</td>
<td>CBRSt = 15</td>
</tr>
<tr>
<td>medium</td>
<td>CBR &lt; 13</td>
<td>CBRSt = 10</td>
</tr>
<tr>
<td>low</td>
<td>CBR &lt; 8</td>
<td>CBRSt = 6</td>
</tr>
<tr>
<td>ultra low</td>
<td>CBR &lt; 4</td>
<td>CBRSt = 3</td>
</tr>
</tbody>
</table>

In Table 2 the classification of the CBR-values is compiled for flexible and rigid pavements.

### Table 2
**Classification of the subgrade factors in the ACN/PCN technique for flexible and rigid pavements (4)**

<table>
<thead>
<tr>
<th>Load-carrying capacity</th>
<th>CBR value (%) - flexible pavements -</th>
<th>k-value (MN/m²) - rigid pavements -</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>15</td>
<td>150</td>
</tr>
<tr>
<td>medium</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>low</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>ultra low</td>
<td>3</td>
<td>20</td>
</tr>
</tbody>
</table>

From these executions it is evident that the PCN of a flexible pavement can be calculated, if the CBR-value of the subgrade and the thickness of the bituminous layers are admitted.

With the ongoing increase of air traffic in the future the question of systematic maintenance plays a crucial role for the airport operators. Apart from the surface properties compared with road systems the substance characteristics will gain in meaning. Compared with the surveying of roads partially different variables of state are of importance. Besides specifications for the use of measuring methods such as geo-radar and Falling Weight Deflectometer (FWD) are necessary (6). At present laboratories in Germany receive inquiries to determine the PCN with the FWD for evaluating the load-carrying capacity of the present airfields. However, so far still no method is known to calculate and evaluate the PCN from FWD measuring data. The objective of this contribution is therefore to present a technique, for calculating the PCN regarding the planning of maintenance activities.

**MEASUREMENTS ON A REGIONAL AIRPORT**

The measurements were executed with the FWD of the Section Road and Pavement Engineering of the Technical University of Darmstadt, Germany in co-operation with the "Institute Dr.-Ing. Gauer" (Regensburg) on the runway of a regional airport. For the determination of the load-carrying capacity of airfields, world-wide approx. 400 FWD are in use (7). The measuring method is among other things in detail described in (8). In Germany at present the measurements are executed in accordance with the manual "Load-Carrying Capacity" of the German Road and Transportation Research Association (9).
On the basis of two examples from the measured data collective the technique for the calculation of the PCN value is demonstrated and the load-carrying capacity characteristic value is evaluated.

**EVALUATION OF THE FWD MEASURING DATA ON THE BASIS OF THE MODEL "SLAB ON ELASTIC ISOTROPIC SEMI INFINITE-SPACE"

The load-carrying capacity characteristic values are evaluated from the deformation hollow measured with the FWD and the maximum of the appropriate force according to (8) with the model "slab on elastic isotropic semi-infinite space", represented in Figure 1.

![Figure 1](image-url)

**Figure 1** Model "slab on elastic isotropic semi-infinite space" (9)

The semi-infinite space consists of the unbound layers of the subgrade. The slab contains all bituminous layers. The load-carrying capacity and the two layer-moduli are evaluated from the following equation (9):

\[
w(r) = \frac{Q}{M_0 \cdot l} \left[ 0.392948 \cdot e^{-0.398483 \cdot \frac{r}{l}} + 0.0137024 \right]
\]

with:

- \(Q\) = maximum Force in N
- \(l\) = flexible length in mm as load-carrying capacity:
  
  \[l = h \cdot \sqrt[3]{\frac{M_1}{6 \cdot M_0}}\]

Layer-moduli in N/mm²:

\[M_1 = \frac{E_1}{1 - \mu_1^2} \quad M_0 = \frac{E_0}{1 - \mu_0^2}\]
Without the knowledge of the layer thickness $h_1$ the following results can be evaluated (9):

- Load-carrying capacity (flexible length) $l$ in mm,
- Layer-modulus $M_0$ of the semi-infinite space in N/mm$^2$

This measuring and evaluation technique has been applied apart from airfields on motorways (bituminous- and concrete-pavements), on cold recycled pavements (10), (11), (12) on pavements in asphalt construction in the context of planning and execution of maintenance activities on urban streets (13) and also on roads with concrete block-pavements (14).

Table 3 contains the load-carrying capacity characteristic values that were calculated for the two examples of the regional airport.

<table>
<thead>
<tr>
<th>Example</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer-modulus $M_0$ N/mm$^2$</td>
<td>120</td>
<td>179</td>
</tr>
<tr>
<td>flexible length $l$ (load-carrying capacity) mm</td>
<td>135</td>
<td>49</td>
</tr>
</tbody>
</table>

With the "provisional evaluation chart" (15) the load-carrying capacity can be evaluated for pavements of the building class III according to the RStO 01 (16), a German regulation for the standardization of pavements. This evaluation results in for the two examples:

- the required load-carrying capacity (flexible length) of $l = 200$ mm is fallen below in the two examples,
- the required layer modulus of $M_0 = 150$ N/mm$^2$ is fallen below in the example 1 and exceeded in the example 2.

From this evaluation it can be seen that on the runway maintenance activities has to be executed, if their stress is situated in the order of magnitude of a road of the building class III. However, the load-carrying capacity of airfields is evaluated on the basis of the PCN.

**DETERMINATION OF THE PCN FROM LOAD-CARRYING CAPACITY MEASUREMENTS WITH THE FALLING WEIGHT DEFLECTOMETER**

As an input into the equation for the calculation of the PCN of flexible pavements, only the CBR-value as an indicator of the subgrade characteristic value for the description of the mechanical behaviour of the building materials is used. However, the behaviour of the bituminous layers is only described by its thickness and not by a material characteristic value. It is evident that during the analysis of the load-carrying capacity measuring data determined with the FWD, the load-carrying capacity of the total system as flexible length $l$ and the layer-modulus $M_0$ of the semi-infinite space are determined. If the layer thickness $h$ of the bituminous layers is known, the corresponding layer-modulus $M_1$ of these layers can be calculated.

With the calculation of the PCN for rigid pavements on the basis of the technique according to Westergaard apart from the k-value of the subgrade (bedding modulus) and the thickness of
the concrete slab also the elastic-modulus of the concrete is used. The Westergaard technique is based on the model "slab on spring bearing" (17) to (23).

With the determination of the PCN from load-carrying capacity measurements with the FWD in (24) it is assumed that the deformation in the load centre of the model "slab on spring bearing" is equivalent to the model "slab on elastic isotropic semi-infinite space" represented in Figure 1. For the CBR-values and k-values specified in Table 2 the following relation was determined:

\[
CBR = 0.2965 \times k^{0.7939}
\]

From these considerations the equation for the determination of the PCN value from FWD measurements follows (24):

\[
PCN_{FWD} = \frac{h_{\text{available}}^2}{878} \times \frac{0.2965 \times k^{0.7939}}{0.2965 \times k^{0.7939} - 12.49}
\]

with:

\[
k = 1.44 \times \left[\frac{M_0 \times l}{M_1 \times h^3}\right] \times \left[\frac{N}{mm^3}\right]
\]

Conversion: \( k \) [MN/m³] into the PCN formula

\[
\frac{1MN}{m^3} = 1000 \times \frac{N}{mm^3}
\]

- \( k = \) bedding modulus (k-value)
- \( l = \) flexible length in mm as load-carrying capacity
- \( M_0 = \) layer-modulus of the semi-infinite space (subgrade) in N/mm²
- \( M_1 = \) layer-modulus of the slab (bituminous layers) in N/mm²
- \( h_{\text{available}} = \) available thickness of the slab (bituminous layers) in cm

The calculation equation for the bedding modulus \( k \) contains the two layer-moduli and the thickness of the slab. Similar equations are specified in (23), (25), (26) for the calculation of the bedding modulus from the flexible material characteristic values by multi-layer systems.

The bedding modulus \( k \) and the PCN_{FWD} are calculated for the values of the flexible length \( l \) and the layer modulus \( M_0 \) and the appropriate layer thicknesses of the bitumen package of the runway specified in the table 3. Using the data from the conditional equation for the flexible length \( l \) the layer-modulus \( M_1 \) of the bituminous package was calculated. Table 4 contains the results of this calculation.
Table 4  Characteristic values of the load-carrying capacity

<table>
<thead>
<tr>
<th>Example</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCN(_{FWD})-value</td>
<td>----</td>
<td>2</td>
</tr>
<tr>
<td>Bedding modulus (k) N/m(^3)</td>
<td>183</td>
<td>870</td>
</tr>
<tr>
<td>flexible length (l) (load-carrying capacity) mm</td>
<td>135</td>
<td>49</td>
</tr>
<tr>
<td>Layer-modulus (M_0) N/mm(^2)</td>
<td>120</td>
<td>179</td>
</tr>
<tr>
<td>Layer-modulus (M_1) N/mm(^2)</td>
<td>5489</td>
<td>254</td>
</tr>
<tr>
<td>Layer thickness (h_{available}) mm</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

**EVALUATION OF THE LOAD-CARRYING CAPACITY OF AIRFIELDS WITH THE PCN\(_{FWD}\)-VALUE**

The PCN value No. 2 specified in Table 4 describes an air traffic area with a low load-carrying capacity according to the ICAO methodology in accordance with paragraph 2 and the value 51 of an airfield with a high load-carrying capacity. To what extent this appraisal procedure corresponds with the technique for the evaluation of the load-carrying capacity of roads described in the paragraph 4, is presented using both examples specified in table 4.

From the mechanical characteristic values of example 1 it is evident that:

- beside the low PCN\(_{FWD}\) value also low values of the flexible length \(l\) (load-carrying capacity in accordance with paragraph 4) and the layer-modulus \(M_0\) occur.
- the two latter characteristic values are smaller than the required values of \(M_0 \geq 150\) N/mm\(^2\) and \(l \geq 200\) mm for roads of the building class III, specified in the paragraph 4, and in accordance with the RStO 01.
- the layer-modulus \(M_1\) is high: due to the high layer-modulus \(M_1\) and the low layer-modulus \(M_0\) the bituminous layers are stressed strongly on tension, which can lead to a failure.
- in this area e.g. a basic renewal has to be executed.

The mechanical characteristic values of example 2 show that:

- the PCN\(_{FWD}\) is high.
- the layer-modulus \(M_0\) is higher than the required value of \(M_0 \geq 150\) N/mm\(^2\) for roads of the building class III, specified in the paragraph 4, and in accordance with the RStO 01.
- the flexible length \(l\) (load-carrying capacity in accordance with paragraph 4) is lower than the specified required values of \(l \geq 200\) mm for roads of the building class III in accordance with the RStO 01.
- the layer-modulus \(M_1\) is low, i.e. the bituminous layers are damaged (e.g. cracking).
- in this area the bituminous layers has to be milled off e.g. and renewed.

Example No. 2 shows that despite a high PCN\(_{FWD}\), which refers to a high load-carrying capacity of the airfield the flexible length \(l\) (load-carrying capacity in accordance with paragraph 4) indicates a low value due to the damaged asphalt-layers. As it comes out from
the calculation-equation for this value and already indicated, this value is only described by
the geometrical thickness and not by material properties concerning low or high layer-
modulus and influences due to cracking. However, the thickness and the layer-modulus of the
bituminous layers influence the bedding modulus k, as shown in (26) and already referred to.
From this reason and from the calculation equation, no direct relation between the bedding
modulus and the layer-modulus M₀ exists. The evaluation of the load-carrying capacity of
airfields should therefore be evaluated on the basis of mechanical characteristic values, like
the

- layer-modulus M₀ of the semi-infinite space (unbound layers and subgrade)
- layer-modulus M₁ of the slab (bituminous layers)
- flexible length l (load-carrying capacity)

that result from the measurements of the load-carrying capacity with the Falling Weight
Deflectometer (FWD).

Further points of criticism at the ACN/PCN method are described in (5) and compiled below:

- The pavement-system of airfields presupposed in the ACN/PCN technique consists
  of pavements and subgrade. The pavement is thereby only characterized by its
  thickness and the subgrade by its CBR-value. There is no closer specification
  concerning the composition of the pavement, although one of the prerequisites for
  the determination of the CBR-value is the constant relation of E₁/E₂ (E₁ = elastic
  modulus of the pavement, E₂ = elastic modulus of the subgrade). The thicknesses
  of the bound in relation to the unbound layers in the pavement are considered just
  as few as the effect of climatic conditions.

- However, the climatic influence affects both, the bitumen-stiffness, which is
  temperature dependent, and the strength of the unbound layers by the water
  content. With the ACN/PCN technique the effect of the climate conditions is only
  concerned by the value of the subgrade.

- According to Turnbull and Ahlvin (27) the validity of the CBR-formula for
  subgrade has to be limited for the CBR-values to a range from 3 to 12 %. However,
  with the ACN/PCN technique this formula is used also for CBR-values
  above 15 %.

- The CBR-calculation-method is based on a two-layer-system. With the application
  of this technique for airfields a multi-wheel load is converted into an equivalent
  single wheel load, whereby in contrast to the original technique a system the
  homogeneous semi-infinite space was selected. That is why the correctness of
  these results is doubtable. In all cases a poisson’s-ratio µ = 0.5 is used.

- The multiplicity of the documented weaknesses leads to the fact that one must ask,
  whether the empirical CBR-calculation-method for roads may be used at all as
  basis for calculating airfields. Which results can occur during an evaluation with
  the ACN/PCN technique is presented in the following.
Comparison of the results of the ACN/PCN technique with existing airfields: The evaluation in the ACN/PCN technique shows that with constant CBR-value it is sufficient to compare the present thickness of the pavement $h_{\text{coh}}$ with the thickness required $h_{\text{erf}}$ for a type of aircraft. The required thicknesses of a pavement can be calculated thus for each type of aircraft for the respective subgrade category from the ACN values, which the ICAO published. It turns out that at low CBR-values of the subgrade of 3% or 6% relatively large pavement thicknesses (reference thicknesses) is required. Thus, a CBR-value of 3% for a Boeing B 727 (ACN = 66) results in a reference thickness of 1365 mm, for an Airbus A 300 B4 (ACN = 79) results in a reference thickness of 1488 mm and for a Boeing B 747-200 (ACN = 92) results in a reference thickness of 1605 mm. In the glaring contrast to it the airfields of the airport Amsterdam-Schiphol according to (28) only exhibits a reference thickness of 980 mm with a CBR-value of 1.5% to 2%. The corresponding standardized CBR-value of 3% combined with the reference thickness of 980 mm results in a PCN of 34. This PCN stands in contrast to the specified ACNs. Similar results can be shown for the airport Copenhagen which according to (29), (30) exhibits a CBR-value of 7% (standardizes 6%) and a reference thickness of 900 mm which corresponds to a PCN of 61. According to the ACN/PCN calculation the Airbus with ACN = 62 at CBR = 6% and the Boeing B 747-200 with ACN = 71 can not use the airport. Since the indicated types of aircraft operate for years on these airports and the pavement worked obviously, a clear contrast consists between the theory of the ACN/PCN technique and practice.

In order to improve the area of the structural calculation of airfields in (5) the suggestion was made to process standard designs like the RStO for airfields. The processed pavements were conceived for a service life of 20 years. As load an airplane collective was set, consisting of one airplane for each case with two-wheeler -, four-wheeler and complex travel carriage. The size of the volume of traffic is assumed according to the volume of traffic numbers at German airports and is situated thereby far over the number used in the ACN/PCN technique. Nevertheless the results show that determined standard superstructures do not exceed a maximum thickness of 940 mm and therefore are far under the results of the ACN/PCN technique but correspond to the thickness of existing airfields in practice.

The structural calculation of military airfields in Germany is not accomplished with the ICAO method but on the basis of technical guidelines of the Federal Ministry of Defense (paper U III 2) (31), (32), (33). Generally military airfields are calculated with the sections C1 and C2 of these guidelines (32), (33). These calculation catalogues are comparably with the RStO for road constructions. If the airfield is planned in a building method deviating from the calculation catalogue, the calculation is described in section B (31). In this section it is pointed out that the calculation considering the total pavement structure has to be executed according to the multi-layer-theory. The multi-layer-theory is based on the theory of elasticity. The material indices, admissible stresses and strains as well as other numerical definitions of material parameters are fictitious calculation values, into those not only safety-factors and statistical spreads, but also the experiences of the building administration were received.
CONSEQUENCES

The basis for the structural calculation of flexible civilian airfields is represented by the ICAO method (1) to (4), in which the PCN is calculated and evaluated. A high PCN expresses a high load-carrying capacity and a low load-carrying capacity of the pavement is expressed by a low PCN. As input parameters the CBR-value of the subgrade and the thickness of the pavement are required.

The evaluation of the load-carrying capacity of the airfield of the regional airport should take place on the basis of the ICAO method with measuring data, collected with the Falling Weight Deflectometer (FWD). Out of these data the parameters of the layer-modulus M0 of the semi-infinite space (subgrade), the layer-modulus M1 of the slab (bituminous layers) and the flexible length l (load-carrying capacity) and from these values the bedding modulus k of the base can be calculated with the mechanical model according to (8). Between the bedding modulus k and the CBR-value a computational relation consists. From the calculated CBR-values and the thickness of the available pavement of the airfield the \( \text{PCN}_{\text{FWD}} \) -value can be determined.

The example 2 shows that despite a high \( \text{PCN}_{\text{FWD}} \), which refers to a high load-carrying capacity of the airfield the flexible length l (load-carrying capacity) indicates a low value due to the damaged asphalt-layers. From the equation for calculating this value, it becomes significant that concerning the characteristics of the bituminous layers only their thickness and not their material properties (e.g. low or high layer-modulus or cracking influences) is concerned. However, the thickness and the layer-modulus of the bituminous layers apart from this influences the layer-modulus of the subgrade the bedding modulus k, as it was shown and referred to in (26). The load-carrying capacity of airfields should therefore be evaluated on the basis of the mechanical characteristic values like the layer-modulus \( M_0 \) of the semi-infinite space, the layer-modulus \( M_1 \) of the slab and the flexible length l, back-calculated from the results of the measurements with the Falling Weight Deflectometer (FWD).

Further points of criticism at the ACN/PCN method are described in (5) will be compiled in the following chapter. In order to improve the area of the structural calculation of airfields in (5) suggestion were made to likewise process standard designs for airfields like the RStO for road constructions. The processed pavements were conceived for a service life of 20 years. As load an airplane collective was set, consisting of in each case of an airplane with two-wheeler -, four-wheeler and complex travel carriage. The size of the volume of traffic is assumed according to the volume of traffic numbers at German airports and is situated thereby far over the number that is used in the ACN/PCN technique. Nevertheless the results show that determined standard superstructures do not exceed a maximum thickness of 940mm and therefore are far under the results of the ACN/PCN technique but correspond to the thickness of existing airfields in practice.

For calculating of the flexible military airfields calculation catalogues are applied. These standard designs are similarly as specified in the RStO 01 for road constructions. If the airfield is planned in a building method deviating from the calculation catalogue, a corresponding calculation (theoretical calculation technique) has to be executed.
On the basis of the theoretical calculation technique valid for military airfields the stress states in the flexible airfield could be calculated and evaluated with the layer-modulus back-calculated from the measurements with the FWD.
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