EXECUTIVE SUMMARY

V&V Consulting Engineers (Pty) has been appointed to analyse the existing pavement bearing capacity of various airfield side flexible pavement infrastructure components at the Skukuza airport. Falling Weight Deflection (FWD) were done by SRT, traffic estimates and pavement composition data have been provided by the Client while Africon (Pty) Ltd has done the back calculations.

From a detailed visual assessment done during March 2008 no structural problems were noted and only scheduled maintenance (resurfacing) was for seen for the near future (next 2-3 years).

FWD deflections were provided for the following pavements:

- Runway 3m- left and right
- Runway 10m- left and right
- Taxi Way- left and right
- Taxi Way- entrance left and right
- Taxi Way- exit left and right
- Bunker area- left and right
- Circle 1- left and right
- Circle 2- left and right
- Circle 3- left and right
- Parking- left, centre and right
- Road to Hangers- left and right

PCN, LCN and ACN were calculated for all airside flexible pavements assuming the same traffic and same existing pavement structures, which is unlikely to be the case.

Only the PCN, LCN and ACN values calculated from FWD measurements on the runway can be considered accurate enough to be quoted. The degree of accuracy of the parameters calculated for the runway is dependent on the assumptions made in terms of traffic for the 15-year design period.

For the remaining pavements, the same parameters as for the runway were calculated. However, the calculated PCN and LCN may be far from the reality since the following assumptions were made:

- The traffic assumed on these pavements was the same as the traffic assumed for the runway,
- Data Population sizes were too small and results too scattered.
- Some pavements are not believed to be trafficked by aircrafts at all.
- Same existing pavement structures for all airside flexible pavements.

However, the calculated PCN and LCN give an idea of the relative strength of the existing pavements under “unrestricted” usage for the 15-year design period.

For the runway keel area pavement (as reflected by deflection measurements at 3 m to the left and at 3 m to the right of the centreline), the representative ACN of the characteristic aircraft is lower than the representative PCN calculated for the 15-year design period. This indicates that in terms of protection of the subgrade, the existing pavement thickness and stiffness provide suitable protection to the subgrade to carry the cumulative loading expected during the design period.

For the runway pavement outside the keel area (as reflected by measurements at 10 m to the left and at 10 m to the right of the centreline) the ACN of the characteristic aircraft is higher than the PCN calculated for the 15 year-design period. This indicates that the subgrade may be overstressed as a result of the traffic loading expected during the 15-year design period and that some sort of strengthening would be required. However, it is expected that the loading of the areas outside the keel area will be much lower than that expected on the keel area.

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LIST OF APPENDICES

1. INTRODUCTION

1.1 BACKGROUND

The pavement load-carrying capacity is a function of the strength of the pavement, the weight of the aircraft, and the number of applications of the load. The International Civil Aviation Organization (ICAO) has developed a standardized method of reporting pavement strength. This procedure is known as the “Aircraft Classification Number over Pavement Classification Number” (ACN/PCN) method. The ACN is used to express the effect of individual aircraft on different pavements by a single unique number, which varies according to pavement type and subgrade strength without specifying a particular pavement thickness. Conversely, a single unique number can express the PCN of a pavement without specifying a particular aircraft. The ACN and PCN values are defined as follows:

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

b. PCN is a number which expresses the relative load-carrying capacity of a pavement for a given pavement life in terms of a single-wheel load.

The ACN/PCN ratio is indicative of the load-carrying ability of that particular pavement to accommodate that particular aircraft. For a given pavement life and a number of operations for a particular aircraft, there is a relationship between the ACN/PCN ratio and the percent of pavement life used up by the applied traffic. For a given ACN/PCN ratio, a relationship exists for the number of operations that will produce failure of the pavement. These relationships provide a method for evaluating a pavement for allowable load depending on acceptable degree of damage to the pavement or an allowable number of operations of a particular aircraft to cause failure of a pavement. The PCN is coded to indicate the pavement type, subgrade strength category, tire pressure category, and evaluation method. For example: **57/R/C/W/T;** “57” is the numerical PCN value. “R” represents a rigid pavement. The subgrade strength “C” is low and has a K value of 100-200 PSI/in. The “W” indicates that there is no limit on tire pressure. The “T” indicates that the PCN was determined by technical evaluation. The ACN varies depending on the aircraft load and the subgrade strength of the pavement. The system works by comparing the ACN to the PCN, as follows:

a. If the ACN/PCN ratio = 1.0, the predicted failure life of the pavement would equal the design period of the pavement.

b. If the ACN/PCN ratio < 1.0, the pavement will perform satisfactorily, and the pavement life would be greater than its design period.

c. If the ACN/PCN ratio > 1.0, the pavement will be overloaded and the pavement life will be less than its design period.

1.2 DESIGN PERIOD

The design period adopted by the Client is 15 years.

2. AVAILABLE INFORMATION

2.1 EXISTING PAVEMENT

The reported existing pavement consists of:

- Surfacing: Chip & spray & slurry (thickness unknown),
- Base: 150 mm G4
- Subbase: 150 mm EG4
- Selected layer: 150 mm G7
- In situ: G9

Neither as-built nor test-pit data were available. The same pavement was assumed for all airfield side flexible pavement areas.

2.2 DESIGN AIRCRAFT AND AIRCRAFT MOVEMENTS

Three aircraft types were reported to be the main users of the airfield pavements, namely the Dash 8, the new Whisper Jet and the turbo propelled aircrafts operating by SA Airlink.

The characteristic plane is the Dash 8. No reference was made to the series of the aircraft.

The series which are the most critical ACN was chosen for the analysis.

For flexible pavements, the Dash 8 Series 400 ACN is:

TABLE 2.1 ACN FOR CHARACTERISTIC AIRCRAFT

Flexible Pavement sugbrade CBR Class				
Weight	A	B	C	D
Maximum: 279 kN	15	16	18	20
Minimum: 150 kN	8	8	8	10

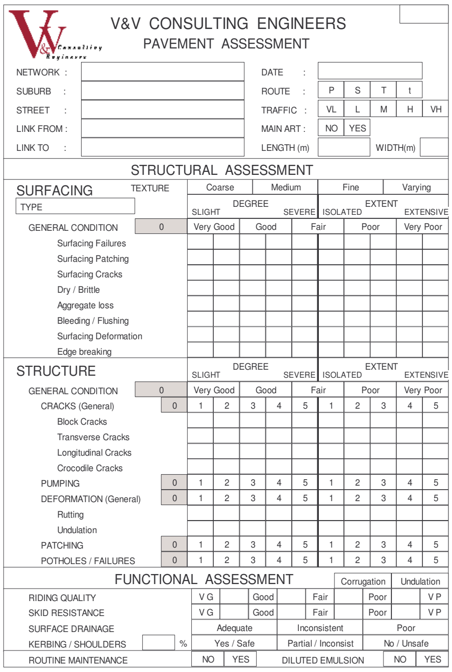
As the parameters of the Dash 8 were not included in the software used, another aircraft (Caravelle Series 100) with exactly the same ACN values was used in the analysis. Four equivalent take-offs of the characteristic aircraft per day with the aircrafts at their maximum take-off weight were assumed.

3. PAVEMENT CONDITION ASSESSMENT

3.1 VISUAL ASSESSMENT

A detail visual assessment (100m sections left and right of the centre line) was done during March 2008. The assessment was done on the standard visual assessment form according to TMH9. The form is divided into ratings for:

- the surfacing.
- the structure.
- the functional condition.



V&V CONSULTING ENGINEERS
PAVEMENT ASSESSMENT

NETWORK :
SUBURB :
STREET :
LINK FROM :
LINK TO :
DATE :
ROUTE : P S T t
TRAFFIC : VL L M H VH
MAIN ART : NO YES
LENGTH (m)
WIDTH(m)

STRUCTURAL ASSESSMENT

SURFACING	TEXTURE	Coarse	Medium	Fine	Varying
TYPE		DEGREE: SLIGHT … SEVERE		EXTENT: ISOLATED … EXTENSIVE	
GENERAL CONDITION	0	Very Good	Good	Fair	Poor / Very Poor

Surfacing Failures
Surfacing Patching
Surfacing Cracks
Dry / Brittle
Aggregate loss
Bleeding / Flushing
Surfacing Deformation
Edge breaking

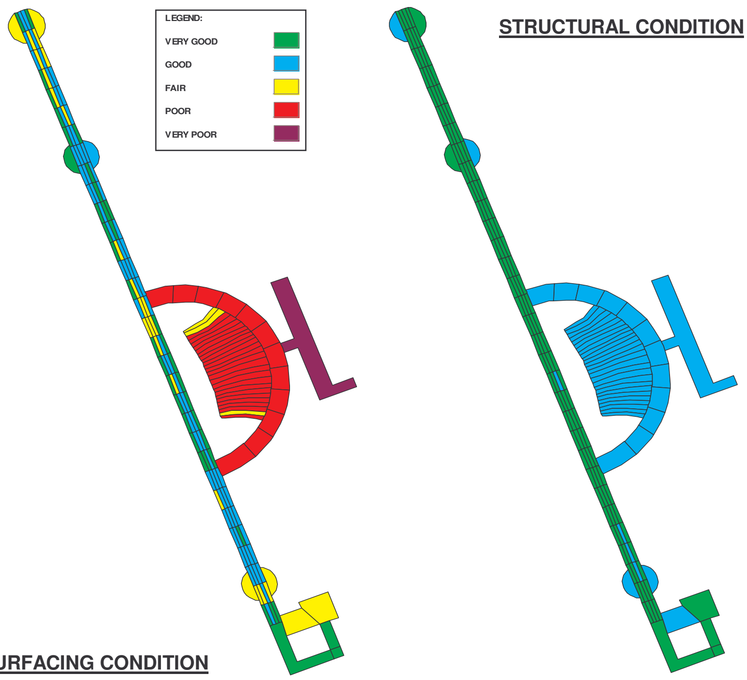
STRUCTURE		DEGREE: SLIGHT … SEVERE					EXTENT: ISOLATED … EXTENSIVE				
GENERAL CONDITION	0	Very Good	Good	Fair			Poor		Very Poor		
CRACKS (General)	0	1	2	3	4	5	1	2	3	4	5
Block Cracks											
Transverse Cracks											
Longitudinal Cracks											
Crocodile Cracks											
PUMPING	0	1	2	3	4	5	1	2	3	4	5
DEFORMATION (General)	0	1	2	3	4	5	1	2	3	4	5
Rutting											
Undulation											
PATCHING	0	1	2	3	4	5	1	2	3	4	5
POTHOLES / FAILURES	0	1	2	3	4	5	1	2	3	4	5

FUNCTIONAL ASSESSMENT

					Corrugation	Undulation
RIDING QUALITY	V G	Good	Fair		Poor	V P
SKID RESISTANCE	V G	Good	Fair		Poor	V P
SURFACE DRAINAGE	Adequate		Inconsistent		Poor	
KERBING / SHOULDERS %	Yes / Safe		Partial / Inconsist		No / Unsafe	
ROUTINE MAINTENANCE	NO	YES	DILUTED EMULSION		NO	YES

The condition of the **surfacing relates** to its quality as a suitable riding surface for traffic and as an **impermeable layer** preventing ingress of water into the pavement structure. The condition of the **structure relates** to its ability to **withstand traffic loads**. The **functional condition** is a measure of the level of service currently provided by the pavement to the **user**.

The visual condition is summarised in the following two schematic diagrams:



The structural condition is a direct indication of the ability of the pavement carrying aircraft in the past. It is thus evident from these diagrams that there are no structural problems on the airfield at this stage and that scheduled maintenance (resurfacing) might be needed in the next two to three years on the runway and taxiways. The bunker area needs immediate attention but is not in use at this stage.

3.2 FWD MEASUREMENTS

Tests using the Falling Weight Deflectometer (FWD) equipment owned by SRT were undertaken on all airfield side pavement areas. The FWD tests were conducted using 9 sensors, so each FWD test provided nine separate and electronically discrete active deflection measurements at spacing 0 mm, 200 mm, 300 mm. 450 mm, 600 mm, 900 mm, 1200 mm, 1500 mm and 1800 mm from the centre of the loading plate. Three tests per point were undertaken with the following plate loads: 40 kN, 80 kN and 120 kN. The FWD plate load used for the analysis was 120 kN.

4. PAVEMENT ANALYSIS

4.1 E-MODULI BACK-CALCULATION

Elmod 5 FWD data analysis software was used for the back-calculation of the elastic moduli from FWD deflections.

The program calculates the modulus of each layer in two, three, four or five layer pavement systems using either the "Radius of Curvature" - Odemark-Boussinesq transformed section approach, the "Deflection Basin Fit" method normally used with numerical integration techniques or using the "FEM/LET/MET" option which allows the user to select either the Finite Element Method, Linear Elastic Theory or the Method of Equivalent Thicknesses. The back calculation provides the apparent moduli for the as-measured deflections at each FWD or HWD test point, and taking the non-linearity of the subgrade (or all layers with FEM) into consideration.

Appendix A includes all the Elmod output data for the various pavements. The data include: Deflections measured by the nine FWD sensors, ii) Back-calculated E-moduli, iii) Equivalent CBR for subgrade, iv) PCN values, v) LCN values, vi) statistical analysis of data.

4.2 ACN, PCN, LCN DETERMINATION - METHODOLOGY

Aircraft Classification Number (ACN)

The Aircraft Classification Number (ACN) is defined by ICAO, using a “mathematically derived single wheel load to define the landing gear/pavement interaction. This is done by equating the thickness given by the mathematical model for an aircraft gear to the thickness for a single wheel at a standard tire pressure of 1,25MPa”. Boussinesq’s equations are used for flexible pavements and Westergaard’s solution for a plate on a Winkler foundation for rigid pavements.

For flexible pavements the thickness is determined from the CBR value, using the equation:

$$t = \sqrt{\frac{DSWL}{0.5692CBR} - \frac{DSWL}{32.035 \times p_S}}$$

where
t is the thickness in cm,
DSWL is the single wheel load in kg, and
ps are the tire pressure (1.25 MPa).

The ACN is two times the derived single wheel load in 1,000 kg. The ACN is calculated by the aircraft manufacturer for 4 subgrade categories (A: CBR > 13, B: 8 < CBR <13, C: 4 < CBR < 8 and D: CBR < 4). The ACN is specific to a particular aircraft and does not depend on the number of operations (the equation above is for 10,000 coverage's) or on the pavement structure (apart from the subgrade category).

The ELMOD5 computer programme by Dynatest was used to calculate the ACN values for deflection tests.

Pavement Classification Number (PCN)
"Aerodrome Design Manual – Part 3 – Pavements", Second Edition 1983, by the International Civil Aviation Organization (ICAO) defines the Pavement Classification Number (PCN) as "A number expressing the bearing strength of a pavement for unrestricted operations".

Pavements deteriorate gradually under the effects of loading and climate. Both the size of the loads and the number of load repetitions are important for the rate of deterioration. The PCN of a given pavement structure will, therefore, depend not only on the pavement structure itself, but also on the expected number of load repetitions. If "unrestricted operations" corresponds to a large number of load repetitions, the PCN will be lower than if it corresponds to a more limited number of repetitions.

Calculation of the PCN at an FWD test point has three steps. In steps one the layer moduli are derived from the deflection basin, at the conditions of the test. In step two the design moduli are determined for each season considered in the design, and in step three the single wheel load that will correspond to the damage criterion for the subgrade, at the specified number of load repetitions, is derived and converted to PCN in the same way as for ACN.

The ELMOD5 computer programme by Dynatest was used to calculate the PCN values for deflection tests.

PCN calculations can be run, whenever back calculations have been carried out for the data file. Results from the PCN calculations can be viewed and compared to ACN values, as depicted in figures below.

LCN (Load Classification numbers) were also calculated at the same time as the PCN values.

ICAO operates with the term "Unrestricted usage" which relates to the actual loading on the airfield. This should not be confused with the 10000 operations used for determining the ACN of an aircraft. Pavements deteriorate gradually under the effects of loading and climate. Both the size of the loads and the number of load repetitions are important for the rate of deterioration. The PCN of a given pavement structure will, therefore, depend not only on the pavement structure itself, but also on the expected number of load repetitions. If "unrestricted operations" corresponds to a large number of load repetitions, the PCN will be lower than if it corresponds to a more limited number of repetitions.

Following the above reasoning, should the number of load repetitions be expected to vary (different design period, different aircraft composition, different number of aircraft movements, the PCN is expected to vary too. The PCN is not a unique number for each airport pavement, as it is widely believed.

5. ACN, PCN, LCN CALCULATED VALUES

5.1 RUNWAY

The following paragraphs summarize the results obtained from FWD deflections measured on the runway at 3 and 10 m to the right and to the left off the centreline.

5.1.1 FWD deflections measured at 3 m (right and left) of centreline

Figure 5.1/1 below depicts the FWD deflections measured at 3 m right and left of the centreline. No well defined uniform sections could be delineated, so the entire runway was considered to be one uniform section.

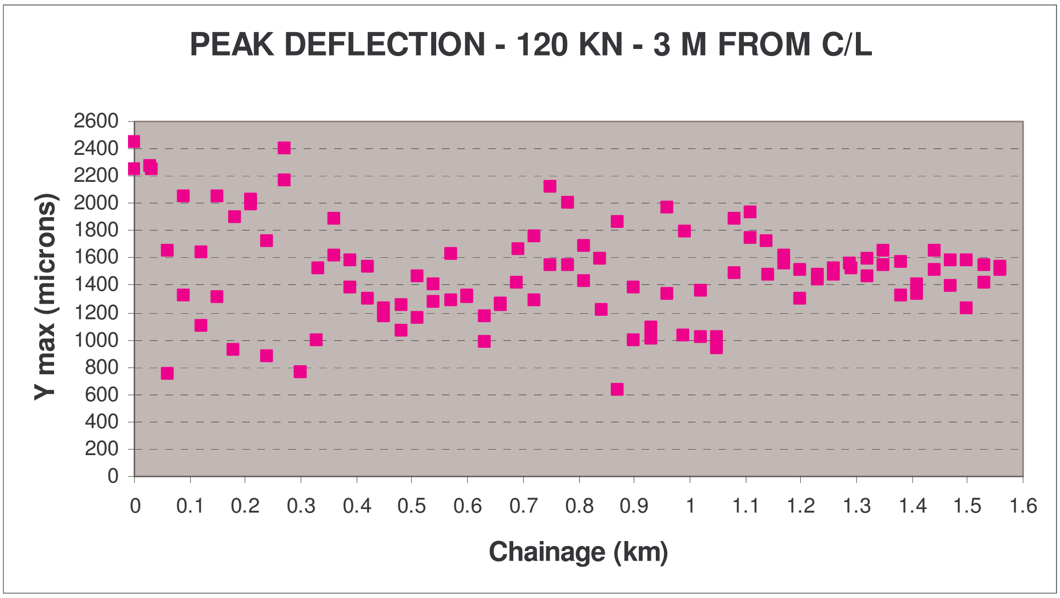


FIGURE 5.1/1: PEAK FWD DEFLECTIONS GENERATED WITH A 120 KN PLATE LOAD, MEASURED AT 3 M RIGHT AND LEFT CENTRELINE OFFSETS

Figure 5.1/2 depicts the PCN calculated from E-moduli back-calculated from FWD deflections measured at 3 m right and left of the centreline. The results are scattered although most results fall within the 20 to 50 range.

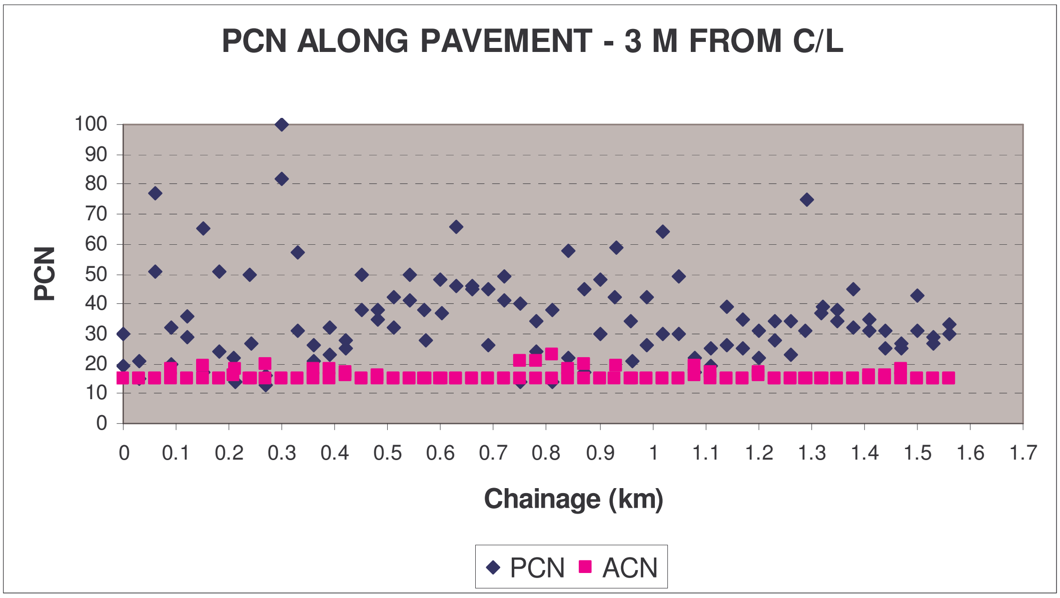


FIGURE 5.1/2: PCN VALUES FROM FWD DEFLECTIONS MEASURED AT 3 M OFFSET FROM CENTRELINE

Figure 5.1/3 below shows the distribution of the PCN values "back-calculated" from FWD measurements at 3 m offsets from centreline. The 85th percentile value falls within the "20 to 22.5" range. The ACN of the characteristic aircraft under prevailing subgrade conditions is 15.6.

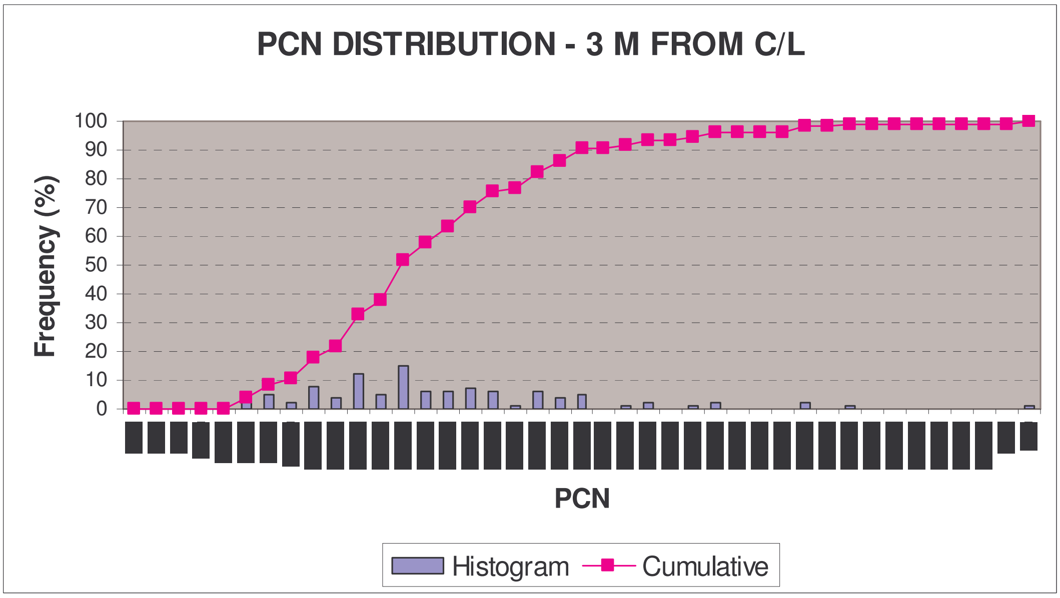


FIGURE 5.1/3: CUMULATIVE DISTRIBUTION OF PCN RESULTS

Figure 5.1/4 below shows the distribution of the LCN values “back-calculated” from FWD measurements at 3 m offsets from centreline. If the 85th percentile value is considered, then the representative LCN ranges between 35 and 37.5.

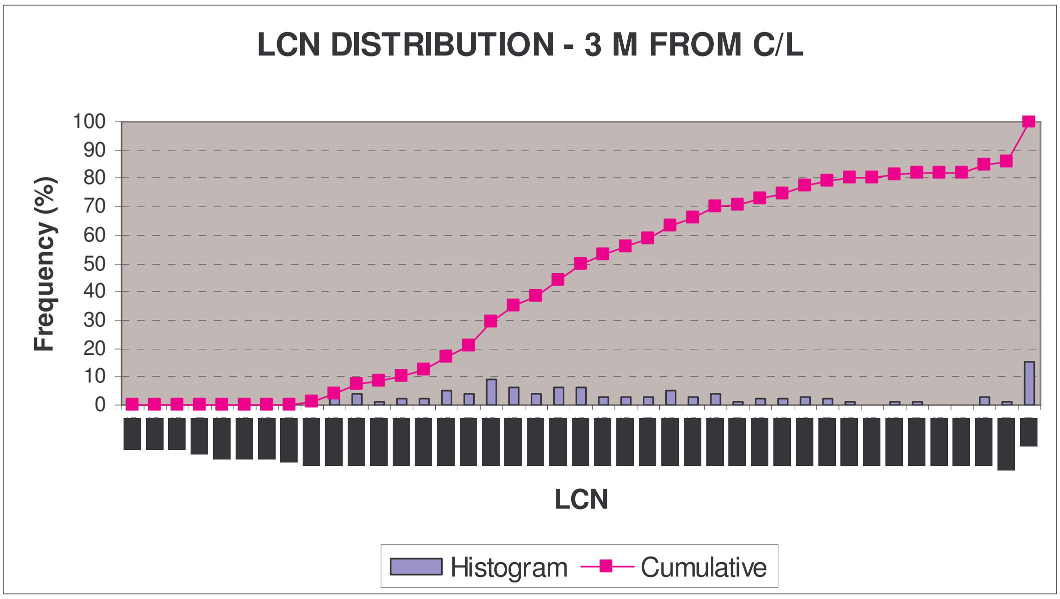


FIGURE 5.1/4: CUMULATIVE DISTRIBUTION OF LCN RESULTS FROM FWD MEASURED AT 3 M RIGHT AND LEFT CENTRELINE OFFSETS

Field CBR values were derived from the back-calculated E-moduli for the subgrade by applying the following expression (from Powel, et al):

$E = 17.6 * CBR^{0.64}$

The representative field subgrade CBR for the runway (3 m left and right of the centreline) can be derived from Figure 5.1/5 below. The 85th percentile field CBR is likely to be 13. The characteristic subgrade field CBR is borderline between CBR classes “A” and “B”. Subgrade class “B” is adopted for the PCN number extension.

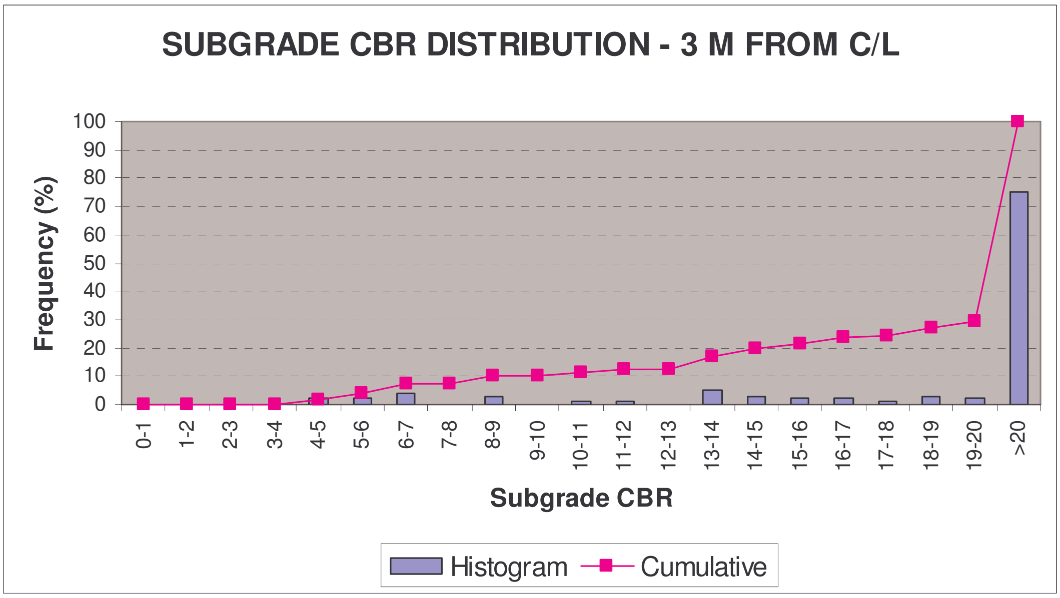


FIGURE 5.1/5: CUMULATIVE DISTRIBUTION OF FIELD CBR RESULTS

Figure 5.1/6 includes a tentative "asphalt overlay design" from Elmod 5, assuming 1,460 annual number of take-offs of the characteristic aircraft and assuming the pavement structure indicated in paragraph 2.1. The "overlay design" is just an indication of pavement layers that may be overstressed and will require repairs, rehabilitation or simply an overlay to be able to withstand the loading during the 15-year design period. The "design" programme of Elmod 5 analyzes every one of the pavement layers (including the subgrade) while the "PCN" programme only focuses on the subgrade. The estimated asphalt overlay thickness requirements are indicated with vertical bars. The first (left) half of the graph includes the overlay requirements for the strip at 3 m left of the centreline and the second (right) half for the strip at 3 m right of the centreline.

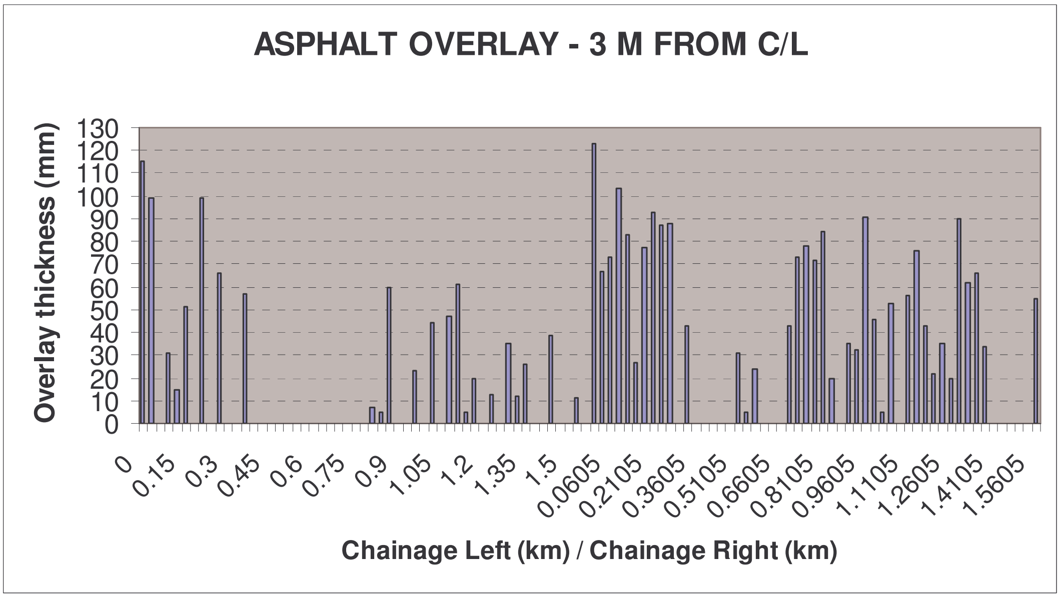


FIGURE 5.1/6: EQUIVALENT ASPHALT OVERLAY THICKNESS TO SATISFY THE 15-YEAR DESIGN PERIOD REQUIREMENTS

Based on FWD test and Elmod 5 output data, the representative PCN and LCN for the pavement are summarized in Table 5.1/1 below.

The fact that the representative PCN is higher than the representative ACN does not imply that the pavement does not require some sort of repair or rehabilitation, as made evident by Figure 5.1/6 above. While the PCN is calculated based on the stresses and strains in the subgrade, the "overlay design" focuses on all pavement layers, and one or some of them may be in an "over-stressed" state that may require some intervention.

TABLE 5.1/1: RUNWAY – 3 M FROM C/L: SUMMARY OF RESULTS

Representative PCN	20 to 22	F/B/W/T
Estimated Field CBR	13	
Representative LCN	35 to 37	
Representative ACN.	16	

5.1.2 FWD deflections measured at 10 m (right and left) of centreline

Figure 5.1/7 below depicts the FWD deflections measured at 10 m right and left of the centreline. No well defined uniform sections could be delineated, so the entire runway was considered to be one uniform section.

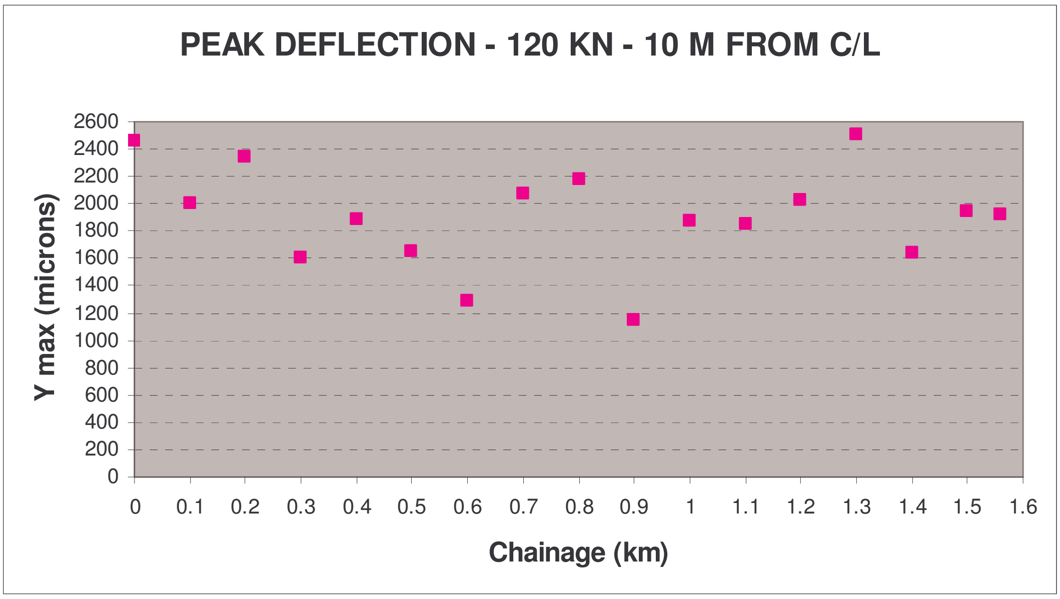


FIGURE 5.1/7: PEAK FWD DEFLECTIONS GENERATED WITH A 120 KN PLATE LOAD, AT 10 M RIGHT AND LEFT CENTRELINE OFFSETS

Figure 5.1/8 depicts the PCN calculated from E-moduli back-calculated from FWD deflections measured at 10 m right and left of the centreline. The results are scattered so the standard deviation is high.

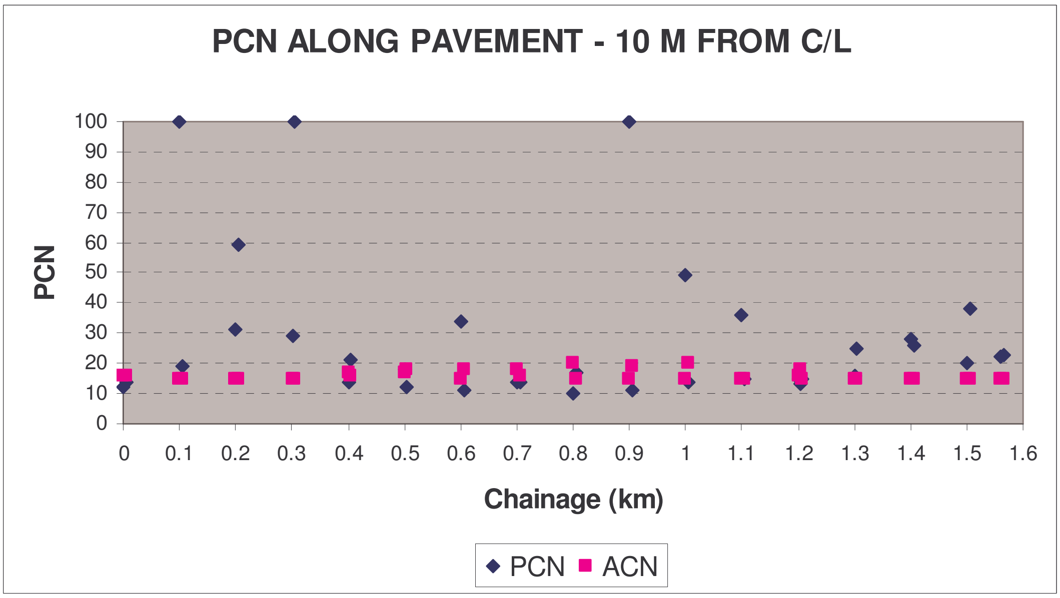


FIGURE 5.1/8: PCN VALUES CALCULATED FROM FWD DEFLECTIONS MEASURED AT 10 M RIGHT AND LEFT CENTRELINE OFFSETS

Figure 5.1/9 below shows the distribution of the PCN values "back-calculated" from FWD measurements at 10 m offsets from centreline. If the 85th percentile value is considered, then the representative PCN will be borderline between the "10 to 12.5" and the "12.5 to 15" PCN groups, most probably closer to 13.

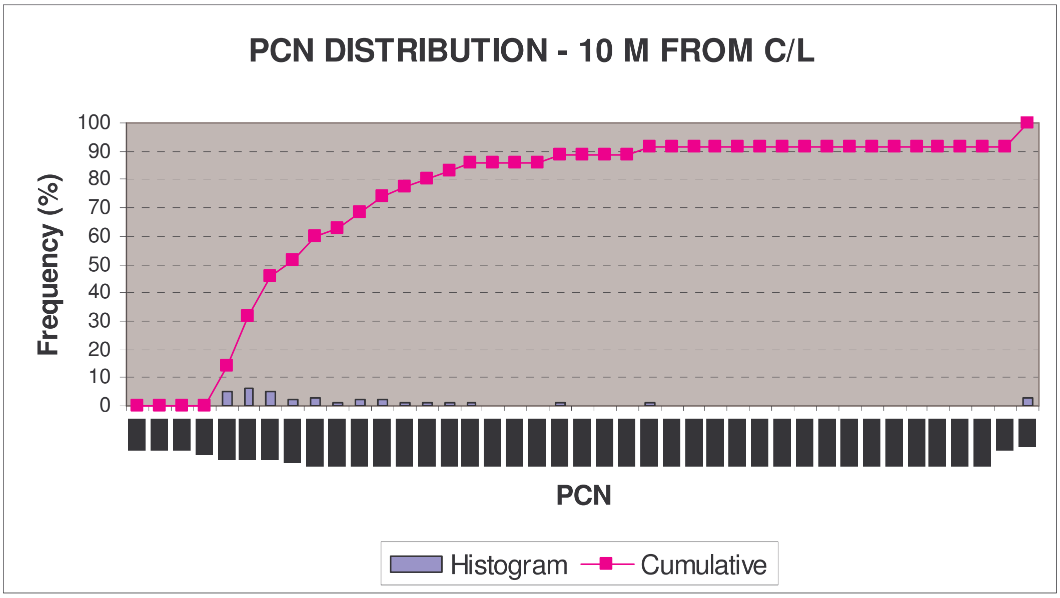


FIGURE 5.1/9: CUMULATIVE DISTRIBUTION OF PCN RESULTS

Figure 5.1/10 below shows the distribution of the LCN values "back-calculated" from FWD measurements at 10 m offsets from centreline. If the 85th percentile value is considered, then the representative LCN ranges between 20 and 22.5, although most probably closer to 20.

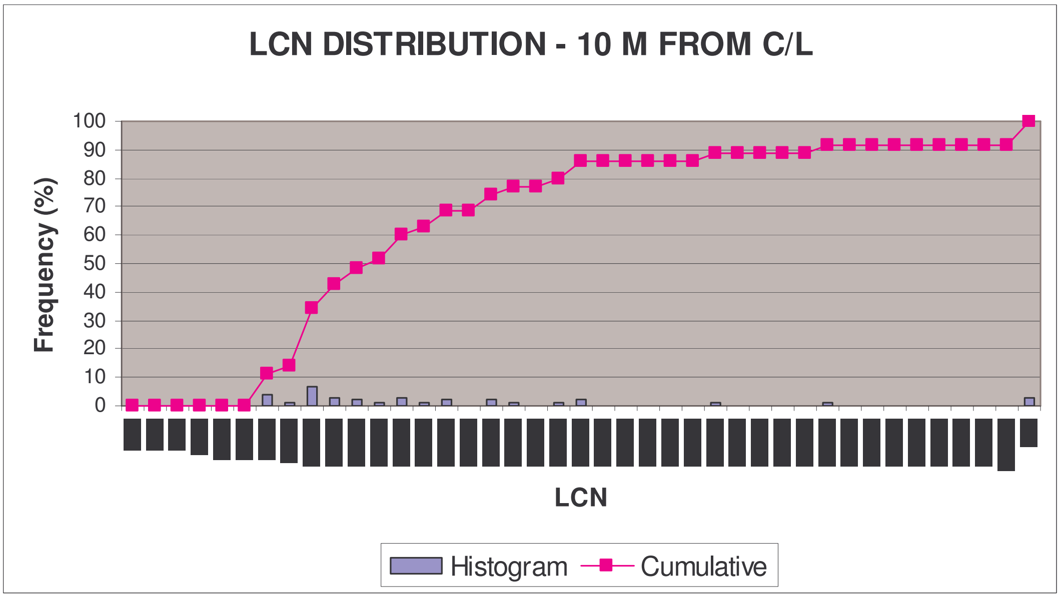


FIGURE 5.1/10: CUMULATIVE DISTRIBUTION OF LCN RESULTS FROM FWD MEASURED AT 3 M RIGHT AND LEFT CENTRELINE OFFSETS

The representative CBR for the runway (10 m of the centreline) can be derived from Figure 5.1/11 below. The 85th percentile field CBR is likely to be within the "7 to 8" CBR range. Therefore, the subgrade class is "C".

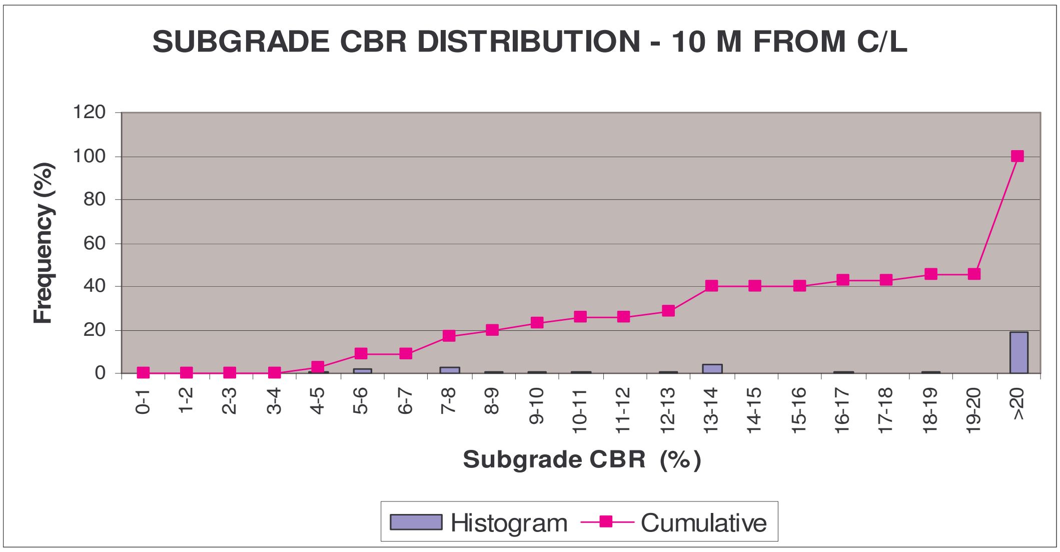


FIGURE 5.1/11: CUMULATIVE DISTRIBUTION OF FIELD CBR RESULTS

Figure 5.1/12 includes an "overlay design" from Elmod 5, assuming that 1460 annual number of take-offs of the characteristic aircraft and assuming the pavement structure indicated in paragraph 2.1. The "overlay design" is just an indication of pavement layers that may be overstressed and will require repairs, rehabilitation or simply an overlay to be able to withstand the loading during the 15-year design period. The estimated asphalt overlay thickness requirements are indicated with vertical bars. The first (left) half of the graph includes the overlay requirements for the strip at 10 m left of the centreline and the second (right) half for the strip at 10 m right of the centreline.

Figure 5.1/12 depicts that the pavement at 10 m (right and left) of the centreline is weaker than the pavement at 3 m (right and left) of the centreline.

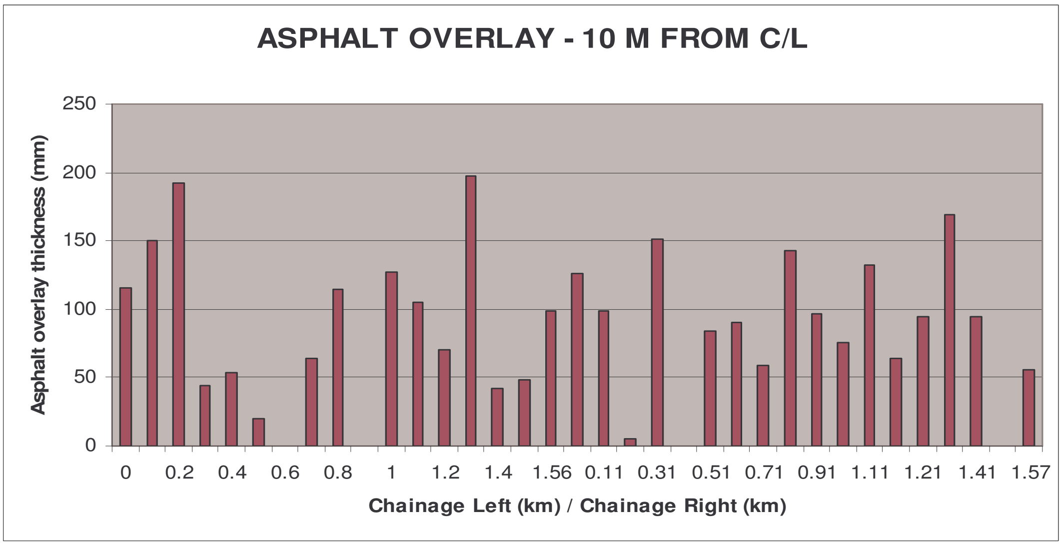


FIGURE 5.1/12: EQUIVALENT ASPHALT OVERLAY THICKNESS TO SATISFY THE 15-YEAR DESIGN PERIOD REQUIREMENTS

A summary of all the representative PCN and LCN values is shown in Table 5.1/2 below. Representative values calculated from FWD deflections measured at 10 m of the centreline are poorer than those calculated from FWD deflections conducted at 3 m of the centreline.

TABLE 5.1/2: RUNWAY - 10 M FROM C/L: SUMMARY OF RESULTS

Representative PCN	13	F/C/W/T
Estimated Field CBR	7 to 8	
Representative LCN	20 to 22	
Representative CAN	16	

5.2 TAXIWAY

Only two FWD tests were carried out on this pavement, thus any statistical analysis will not provide reliable results.

Based on the limited FWD test output data, the representative PCN and LCN for the pavement is summarized in Table 5.2/1 below. Additional testing should be undertaken to confirm the composition and the structural capacity of the pavement.

TABLE 5.2/1: TAXIWAY – SUMMARY OF RESULTS

Representative PCN	Two values: 37 and 54	F/A/W/T
Estimated field CBR	Two values >15	
Representative LCN	Two values > 50	
Representative ACN.	> 15	

5.3 OTHER PAVEMENTS

The PCN and LCN were also calculated for the other pavements where FWD deflections were measured. The calculated values, however, should be considered with caution due to the following reasons:

- The PCN is based on the unrestricted number of operations of the characteristic plane.
- The characteristic aircraft for this area is unknown.
- The number of aircraft movements on this area is unknown.
- The same aircraft traffic as that of the runway and taxiway has been assumed.
- The size of the data population for the various pavement areas was small, thus rendering any statistical analysis of the data less reliable.

The following paragraphs summarize the results obtained from Elmod 5 analysis on areas other than those of the runway and the taxiway.

5.3.1 Taxiway Entrance

Table 5.3/1 summarized the representative parameter values of this pavement.

TABLE 5.3/1: TAXIWAY ENTRANCE – SUMMARY OF RESULTS

Representative PCN (15th percentile)	17.5 - 20	F/A/W/T
Estimated field CBR (15th percentile)	13 – 14	
Representative LCN (15th percentile)	25 – 27.5	
Representative CAN (50th percentile)	15	

Note: 5 FWD tests were conducted

5.3.2 Taxiway exit

Table 5.3/2 summarizes the representative parameters of the pavement.

TABLE 5.3/2: TAXIWAY EXIT – SUMMARY OF RESULTS

Representative PCN (15th percentile)	15 to 17.5	F/A/W/T
Estimated field CBR (15th percentile)	>15	
Representative LCN (15th percentile)	25 – 27.5	
Representative ACN. (50th percentile)	15	

Note: 5 FWD tests were conducted.

5.3.3 Bunker area

Figure 5.3/1 below depicts the FWD deflection measurements on the bunker area pavement. No well defined uniform sections could be delineated, therefore the bunker area was considered to be one uniform section.

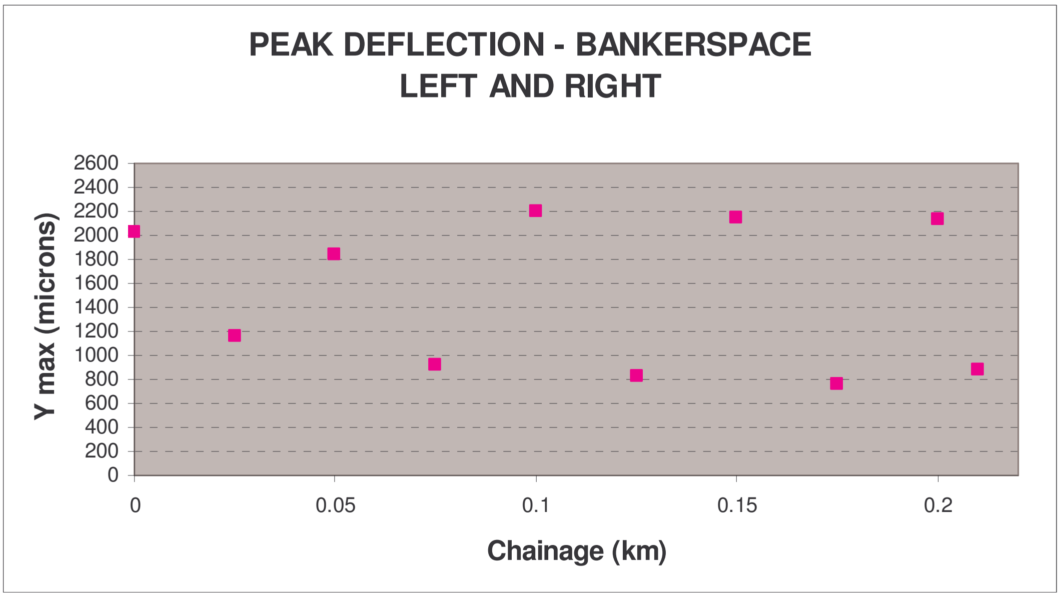


FIGURE 5.3/1: PEAK FWD DEFLECTIONS GENERATED WITH A 120 KN PLATE LOAD – BUNKER AREA

Figure 5.3/2 depicts the PCN calculated from E-moduli back-calculated from FWD deflections measured on the left and right side of the banker.

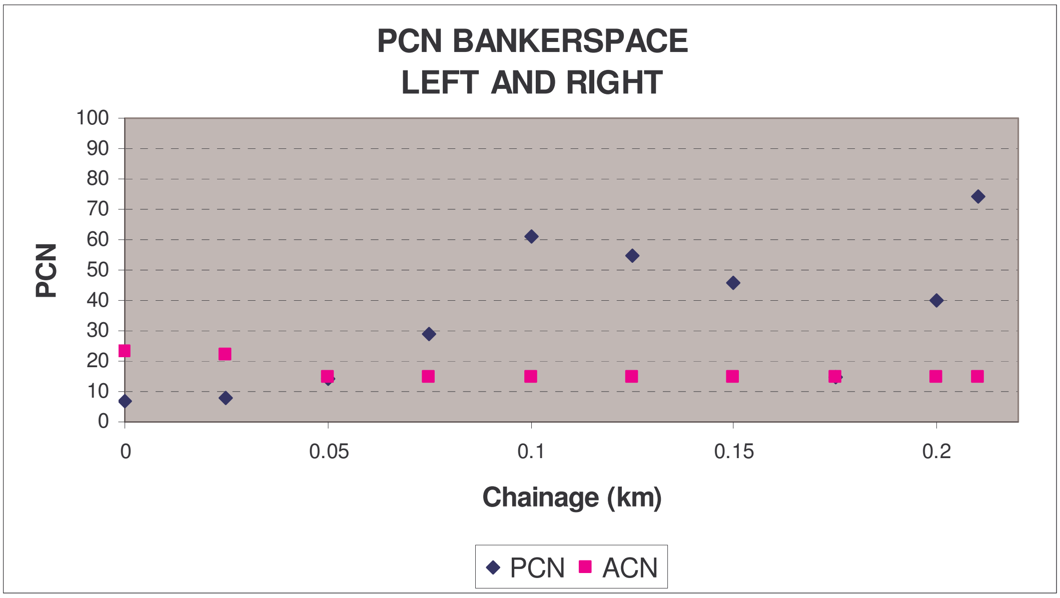


FIGURE 5.3/2: PCN VALUES FROM FWD DEFLECTIONS MEASURED ON THE BUNKER AREA

Table 5.3/3 summarizes the representative parameters of the pavement.

TABLE 5.3/3: BUNKER AREA : SUMMARY OF RESULTS

Representative PCN (15th percentile)	7.5 - 10	F/D/W/T
Estimated field CBR (15th percentile)	3 – 4	
Representative LCN (15th percentile)	16	
Representative ACN. (50th percentile)	15	

Note: FWD test point output data values were used

5.3.4 Bunker

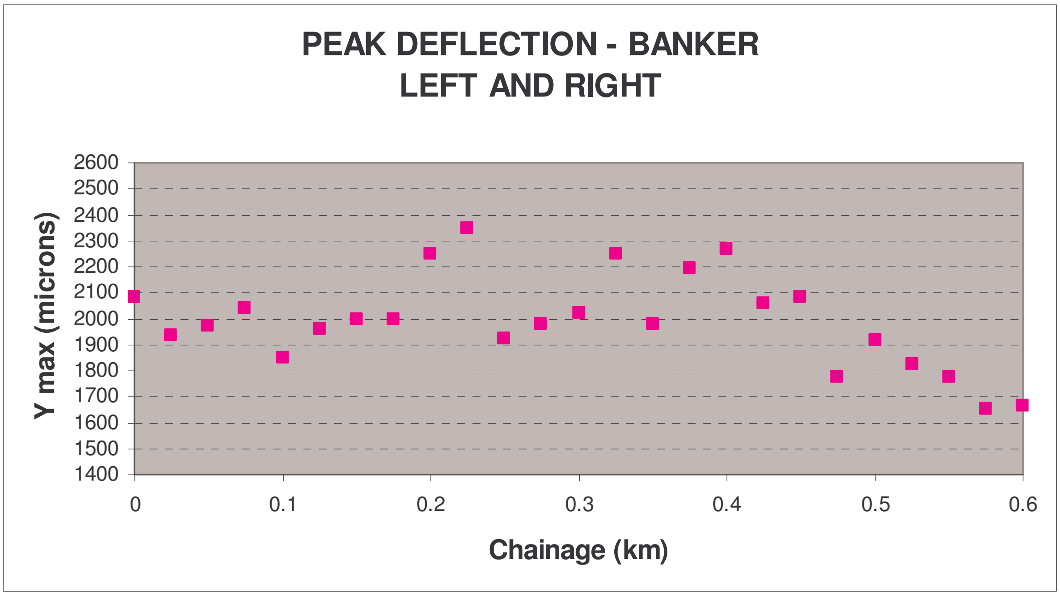


FIGURE 5.3/3: PEAK FWD DEFLECTIONS GENERATED WITH A 120 KN PLATE LOAD ON THE BUNKER AREA

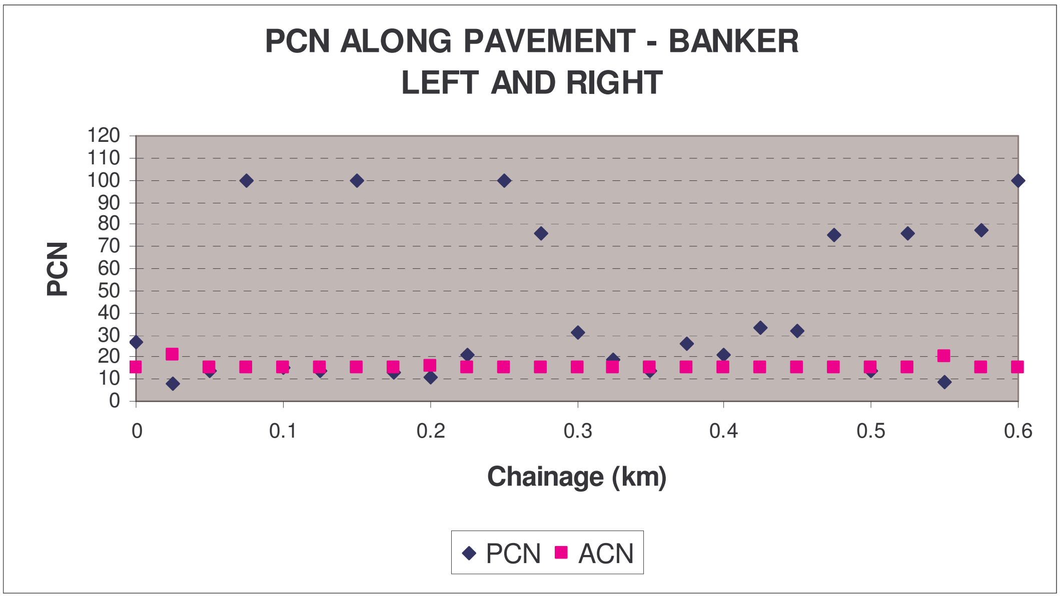


FIGURE 5.3/4: PCN VALUES FROM FWD DEFLECTIONS MEASURED ON THE BUNKER AREA

Table 5.3/4 summarizes the representative parameters of the pavement.

TABLE 5.3/4: BUNKER : SUMMARY OF RESULTS

Representative PCN (15th percentile)	12.5 – 15	F/A/W/T
Estimated field CBR (15th percentile)	16- 17	
Representative LCN (15th percentile)	20 – 22.5	
Representative ACN. (50th percentile)	15	

5.3.5 Circle 1

Table 5.3/5 summarizes the representative parameters of the pavement.

TABLE 5.3/5: CIRCLE 1 – SUMMARY OF RESULTS

Representative PCN (15th percentile)	7.5 – 10	F/D/W/T
Estimated field CBR (15th percentile)	3 – 4	
Representative LCN (15th percentile)	12.5 – 15	
Representative ACN. (50th percentile)	16	

Note: Results derived from 6 FWD tests were used.

5.3.6 Circle 2

Table 5.3/6 summarizes the representative parameters of the pavement.

TABLE 5.3/6: CIRCLE 2 – SUMMARY OF RESULTS

Representative PCN (15th percentile)	12 to 13	F/A/W/T
Estimated field CBR (15th percentile)	5 to 38	
Representative LCN (15th percentile)	18 to 19	
Representative ACN. (50th percentile)	15	

Note: Results derived from 6 FWD tests were used.

5.3.7 Circle 3

Table 5.3/7 summarizes the representative parameters of the pavement.

TABLE 5.3/7: CIRCLE 3 – SUMMARY OF RESULTS

Representative PCN (15th percentile)	20 – 22.5	F/A/W/T
Estimated field CBR (15th percentile)	> 20	
Representative LCN (15th percentile)	27.5 – 30	
Representative ACN. (50th percentile)	15	

Note: Results derived from 6 FWD tests were used.

5.3.8 Parking

Table 5.3/8 summarizes the representative parameters of the pavement.

TABLE 5.3/8: PARKING – SUMMARY OF RESULTS

Representative PCN (15th percentile)	45 – 47.5	F/A/W/T
Estimated field CBR (15th percentile)	> 20	
Representative LCN (15th percentile)	62.5 – 65	
Representative ACN. (50th percentile)	15	

Note: Results derived from 8 FWD tests were used.

5.3.9 Road to Hangers

Table 5.3/9 summarizes the representative parameters of the pavement.

TABLE 5.3/9: ROAD TO HANGERS – SUMMARY OF RESULTS

Representative PCN	17.5 – 20	F/B/W/T
Estimated CBR	8 – 9	
Representative LCN	27.5 – 30	
Representative ACN.	15	

Note: Results derived from 3 FWD tests were used.

6. CONCLUSIONS

Only the PCN, LCN and ACN values calculated from FWD measurements on the runway can be considered accurate enough to be quoted. The degree of accuracy of the parameters calculated for the runway is dependent on the assumptions made in terms of traffic for the 15-year design period.

For the remaining pavements, the same parameters as for the runway were calculated. However, the calculated PCN and LCN may be far from the reality since the following assumptions were made:

- The traffic assumed on these pavements was the same as the traffic assumed for the runway,

- Data population were too small and results too scattered.

- Some pavements are not believed to be traffic by aircrafts at all.

However, the calculated PCN and LCN give an idea of the relative strength of the existing pavements under “unrestricted” usage.

For the runway keel area pavement (as reflected by measurements at 3 m to the left and at 3 m to the right of the centreline), the ACN of the characteristic aircraft is lower than the PCN calculated for the 15-year design period. This indicates that in terms of protection of the subgrade, the existing pavement thickness and stiffness provide suitable protection to the subgrade.

For the runway pavement outside the keel area (as reflected by measurements at 10 m to the left and at 10 m to the right of the centreline) the ACN of the characteristic aircraft is higher than the PCN calculated for the 15 year-design period. This indicates that the subgrade may be overstressed as a result of the expected loading during the 15-year design period and that some sort of strengthening is required. However, it is expected that the loading of the areas outside the keel area will be much lower than that expected on the keel area.

7. REFERENCES

1. Aerodrome Design Manual, Part 3, Pavements, Second Edition. International Civil Aviation Organization. 1983.

2. Advisory Circular No.: 150/5320-6D, Change 3. Airport Pavement Design and Evaluation. U.S. Department of Transportation. Federal Aviation Administration.

3. A Guide to Airfield Pavement Design and Evaluation. Directorate of Civil Engineering Services, Department of the Environment. United Kingdom.

APPENDIX A: RUNWAY - ELMOD 5 OUTPUT DATA AND DATA ANALYSIS

APPENDIX B: OTHER AIRFIELD PAVEMENTS - ELMOD 5 OUTPUT DATA AND DATA ANALYSIS