Airfield Pavement Evaluation Practice Problems
Army

At the request of the U.S. Army Infantry Center, Fort Benning, Georgia, field testing was performed at Lawson Army Airfield (LAAF) on 01 October 2004. The results of the field testing are summarized in Table 10, Summary of Physical Property Data. Layer information for the facilities at LAAF were obtained from direct field tests (CBR or Plate Bearing), Non-Destructive Testing (NDT), and by Dynamic Cone Penetrometer (DCP) Tests. You are to analyze the pavements using the steps outlined below and report the strengths of the identified features to the Commander.

Step 1. Create database and save the file name as LAAF.pvr.

Step 2. Build Traffic Patterns for each feature using the traffic information given in Tables 1A. Use a 20-year design life. Be sure to edit the settings to the appropriate pavement type, subgrade category and traffic areas given in Table 1B. (*Hint: use Copy Pattern after the first pattern is created, then change the settings for each following traffic pattern*)

Step 3. CBR and Plate Bearing tests were used to obtain strength information for features R08C and A27B. Use the CBR and K values reported in Table 10 and summarized in Table 2, to determine the PCNs for these features. Use the APE analysis and report the PCNs on Table 7.

Step 4. The Falling Weight Deflectometer was used to evaluate features R10A and A07B. Use the backcalculated modulus values reported in Table 10 and summarized in Table 3, to determine the PCNs for these features. Use the LEEP analysis and report the PCNs on Table 7.

Step 5. The DCP was used to evaluate the pavements on R01A and T06B. Use the DCP module and the blows and penetrations given in Tables 4 and 5 to obtain CBR/K values. Then use the Evaluation Module to obtain the resulting PCNs for these features. Use the APE analysis and report the PCNs on Table 7.

Due to a potential new mission, LAAF may be used to support C-17 aircraft operating at a take-off weight of 263,084 kg (580,000 lb). Determine if the pavement facilities at LAAF can support the C-17 traffic. Steps for this process are outlined below.

Step 6. Obtain the ACN for the 263,084 kg (580,000 lb) C-17 and report results in Table 8. *(Hint: ACNs can be found in the Vehicle Editor module or on-line at www.triservicetransportation.com under Software Applications.)*

Step 7. From Table 8 select the appropriate ACN and transfer it to Table 9.

Step 8. Report the ACN/PCN ratio in Table 9 and determine the pavement performance rating for the new mission traffic.

Traffic for LAAF

Table 1A – Annual Traffic Data for LAAF			
Aircraft	**Weight kg (lb)**	**12-month Period**	**20-year Traffic**
B-727	95 028 (209,500)	400	8,000
B-747	361 967 (798,000)	12	240
B-767	185 519 (409,000)	12	240
C-141	146 510 (323,000)	400	8,000
DC-10-40	264 444 (583,000)	12	240

Table 1B – Summary of Pavement Type, Subgrade and Traffic Area at LAAF					
Pattern (Feature) Name	**Number of Design Periods**	**Analysis Type**	**Pavement Type**	**Subgrade Category**	**Traffic Area**
R01A	1	Mixed	Flexible	D	A
R08C	1	Mixed	Flexible	A	C
R10A	1	Mixed	Rigid	B	A
T06B	1	Mixed	Flexible	C	B
A07B	1	Mixed	Flexible	B	B
A27B	1	Mixed	Rigid	C	B

Pattern Name	Critical Vehicle	Design Load (lb)	Equivalent Passes
R01A			
R08C			
R10A			
T06B			
A07B			
A27B			

Physical Properties for LAAF

Table 2 – Summary of Physical Data for Features Evaluated with CBR & Plate Bearing Tests						
Feature	**Surface Condition**	**Layer Type**	**Material Type**	**Thickness**	**CBR or K**	**Flexural Strength**
R08C	Very Good	Asphalt	---	10	---	---
		Base	Unbound Aggregate	9	100	---
		Subbase	Unbound Subbase	12	20	---
		Natural Subgrade	Cohesionless Fill	---	14	---
A27B	Very Good $C_{b,r} = 0.8$	PCC	---	13	---	750
		Natural Subgrade	Cohesionless Fill	---	177	---

Table 3 – Summary of Physical Data for Features Evaluated with Non-Destructive Testing						
Feature	**Surface Condition**	**Layer Type**	**Material Type**	**Thickness**	**Modulus psi**	**Flexural Strength**
R10A	Very Good $C_{b,r} = 0.9$	PCC	---	16	9,635,585	700
		Base	Unbound Aggregate	4	28,387	---
		Natural Subgrade	Cohesionless Fill	---	28,387	---
A07B	Fair	Asphalt	---	5	526,382	---
		Base	Unbound Aggregate	18	55,477	---
		Natural Subgrade	Cohesionless Fill	---	17,655	---

Dynamic Cone Penetrometer (DCP) Results

Table 4 – Feature T06B	
Blows	**Penetration (mm)**
0	152
14	200
14	255
14	312
14	370
14	425
7	480
7	530
7	600
7	650
7	710
3	800
3	900
3	1000
3	1080
3	1190
3	1300

Feature T06B

According to Previous reports the structure is thought to be made up of the following layer structure – if necessary move/delete/add lines on the data reduction graph to reflect the thicknesses below and report the CBR for each layer. The existing surface is in FAIR condition.

Layer	Material Type	Frost Code	Thickness (inches)	CBR
AC	---	---	6	--
Base	Unbound Aggregate	F0	12	
Subbase	Unbound Subbase	F0	12	
Natural Subgrade	Cohesive Cut	F0	--	

Table 5 – Feature R01A	
Blows	**Penetration (mm)**
0	203
15	243
15	285
15	329
13	356
10	427
10	498
8	560
2	660

Feature R01A

According to Previous reports the structure is thought to be made up of the following layer structure – if necessary move/delete/add lines on the data reduction graph to reflect the thicknesses below and report the CBR for each layer. The existing surface is in POOR condition.

Layer	Material Type	Frost Code	Thickness (inches)	CBR
AC	---		8	--
Base	Unbound Aggregate	F0	10	
Subbase	Unbound Subbase	F0	6	
Natural Subgrade	Cohessionless Fill	F0	--	

Table 6 – Not Used

Table 7 – Analysis Results for Current Traffic

Facility	Feature	PCN	Allowable		Overlay Requirements		
			Load (kips)	Passes	AC	PCC No Bond	PCC Partial Bond
Runway 15-33	R01A						
	R08C						
	R10A						
Taxiway Alpha	T06B						
Red Ramp	A07B						
	A27B						

Table 8 - ACN Values			
AC Pavements			
Aircraft	**Weight kg (lb)**	**Subgrade Category**	**ACN**
C-17	263 000 (580,000)	A	
		B	
		C	
		D	
PCC Pavements			
Aircraft	**Weight kg (lb)**	**Subgrade Category**	**ACN**
C-17	263 000 (580,000)	A	
		B	
		C	
		D	

Table 9 – Analysis Results for C-17					
Facility	**Feature**	**ACN**	**PCN**	**ACN/PCN**	**Expected Performance***
Runway 15-33	R01A				
	R08C				
	R10A				
Taxiway Alpha	T06B				
Red Ramp	A07B				
	A27B				

*Army Performance Rating:

ACN/PCN>1.5 Emergency Operations only

1.0<ACN/PCN≤1.5 Limited to 10 passes with inspection

ACN/PCN≤1.0 Full aircraft operations

Airfield Pavement Evaluation Practice Problems
Army – Frost Considerations

Evaluate the sections below at Fort Wainwright, Alaska (WAAF) for non-frost and thaw conditions. Ft. Wainwright is close to Fairbanks, Alaska and the thaw season is from May through July.

Based on the traffic provided by the base the 20-year total equivalent aircraft for each pavement type calculated out to be:

PCC – 636 passes of the Boeing-727 @ 95 000 kg (209,500 lb)
AC – 904 passes of the C-17 @ 263 000 kg (580,000 lb)

WAAF Summary of Physical Data for Features Evaluated with CBR & Plate Bearing Tests									
Feature	**Surface Condition**	**Layer Type**	**Material Type**	**Frost Code**	**Thick-ness**	**CBR or K**	**Flexural Strength**	**Dry Unit Weight**	**Moisture Content**
R03A	Fair $C_{b,r} = 0.65$	PCC	---	F0	7	---	650	145	0
		Base	Unbound Aggregate	F0	32	---	---	135	10
		Natural Subgrade	Cohesionless Fill	F3	---	88	---	125	20
T11A	Good $C_{b,r} = 0.85$	AC	---	F0	4	---	---	140	0
		Base	Unbound Aggregate	F0	6	68	---	135	10
		Subbase	Unbound Subbase	F0	14	27	---	125	15
		Natural Subgrade	Cohesionless Fill	F3		9	---	120	20

WAAF Analysis Results									
Feature	**Season**	**Design Passes**	**ACN**	**PCN**	**Allowable**		**Overlay Requirements**		
					Load (kips)	**Passes**	**AC**	**PCC No Bond**	**PCC Partial Bond**
R03A	Normal								
	Thaw								
T11A	Normal								
	Thaw								