

FAARFIELD 2.1 Hands-On Training

ACR-PCR Considerations

Presented to: ASCE 2026 T&DI
International Airfield & Highway Pavements Conference

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Date: June 28, 2026



**Federal Aviation
Administration**



FAARFIELD 2.1.1 (Build 12/21/2023)

File Edit Batch Run Selection Select All DeSelect All PAVEAIR Access Help Reset Exit

Explorer Structure PAVEAIR Access

Job Information
Design Options
Summary Report
Structures

FlexibleExample1
Structure Report
CDF Graph
PCR Report
PCR Graph
Airport Master Reco

FlexibleExample2
Structure Report
CDF Graph
PCR Report
PCR Graph
Airport Master Reco

RigidExample1
Structure Report
CDF Graph
PCR Report
PCR Graph
Airport Master Reco

RigidExample2
Structure Report
CDF Graph
PCR Report
PCR Graph
Airport Master Reco

RigidExample3
Structure Report
CDF Graph
PCR Report
PCR Graph
Airport Master Reco

Structure PAVEAIR Access

Job Name: ACR-PCR_Workshop_2024 PCR Run

Status Gear Structure

Structure Name: RigidExample1 ☒ Include in Summary Report ☐ Add To Batch

Pavement Layers
Pavement Type: New Rigid

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	16.0	4,000,000		650
P-401/P-403 HMA Stabilized	8.0	400,000		
P-209 Crushed Aggregate	6.0	24,405		
Subgrade		7,800	103.6	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20 P/T Ratio: 1

The standard design life for pavement structure is 20 years (1 to 50 allowed).

Results
Calculated Life (Years): Total thickness to the top of the subgrade (in.): 30.0

Copy Structure to Clipboard

Traffic

Stored Aircraft Mix ACRPCR_Workshop_Traffic Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (lbs)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (psi)	Percent GW on Gear	Tire Contact Width (in.)	Tire Contact Length (in.)	Tire Contact Area (in. ²)
A300-B4/C4 Std Bogie	365,747	1,500	0	30,000	0.11	3.65	216	0.95	12.6	20.2	201.0	
A319-100 std	141,978	1,200	0	24,000	0	3.73	173	0.95	12.5	19.9	194.9	
B737-300	140,000	6,000	0	120,000	0	3.88	201	0.95	11.5	18.4	165.4	
B747-400	877,000	1,000	0	20,000	0.66	0.66	3.5	200	0.475	14.4	23.0	260.4
B747-400 Belly	877,000	1,000	0	20,000	0	0.66	3.51	200	0.475	14.4	23.0	260.4

Notes User Information

Overload ACR-PCR Example



Overload Example

A rigid pavement is being evaluated for ACR-PCR at a commercial airport. Based on the information obtained from the Airport Master Plan, the runway is expected to handle the traffic mix presented in Table 1. Eight soil borings were performed for this project, the results of which are presented in Table 2. The specified 28-day strength (ASTM C78) is 4.27 MPa.

Table 1. Aircraft traffic mix for rigid pavement design example.

Aircraft	Departure Weight, kg	Arrival Weight, kg	Annual Departures
S-30	13,608	10,206	8000
Fokker F-100	44,452	34,019	6500
B737-300	62,822	52,163	5000
B767-300 ER	158,757	131,541	3200
A380-800	544,310	462,664	400
B777-300	263,083	237,682	1500

Same as previous examples!

Table 2. Soil boring results for rigid pavement design example.

Boring No.	UCSC Soil Type	Moisture Content, %	Optimal MC, %	Dry unit weight, kN/m ³	Water Table Depth, m	CBR, %
B-1	SC	12.2	10.4	20.26	3	10.6
B-2	SC	14.4	12.2	19.57	3	7.2
B-3	SC	16.5	9.6	20.80	2.5	8.4
B-4	CL	15.8	13.5	18.88	2.0	6.3
B-5	CL	17.0	14.5	19.24	2.4	4.8
B-6	CL	16.2	13.8	18.96	1.7	5.9
B-7	CL	16.8	12.6	19.48	1.4	4.2
B-8	CL	14.2	12.8	20.14	1.8	6.4
Average:						
Std. Deviation:						



Rigid Pavement Evaluation

- 28-Day strength was 670 psi
- Design strength was 700 psi
- Testing found PCC strength was 670 psi
- All other factors stayed same

FAAIRFIELD 2.1.2 (Build 06/03/2028)

Job Name: New Job 2 | Structure Name: Rigid Pavement Example | Pavement Type: New Rigid

Material	Thickness (in.)	E (psi)	k (pci)	k (psi)
P-501 PCC Surface	16.0	4,000,000		670
P-306 Lean Concrete	5.0	700,000		
P-209 Crushed Aggregate	8.0	25,027		
Subgrade	7.050		95.8	

Design Life (Years): 20 | P/TC Ratio: 1

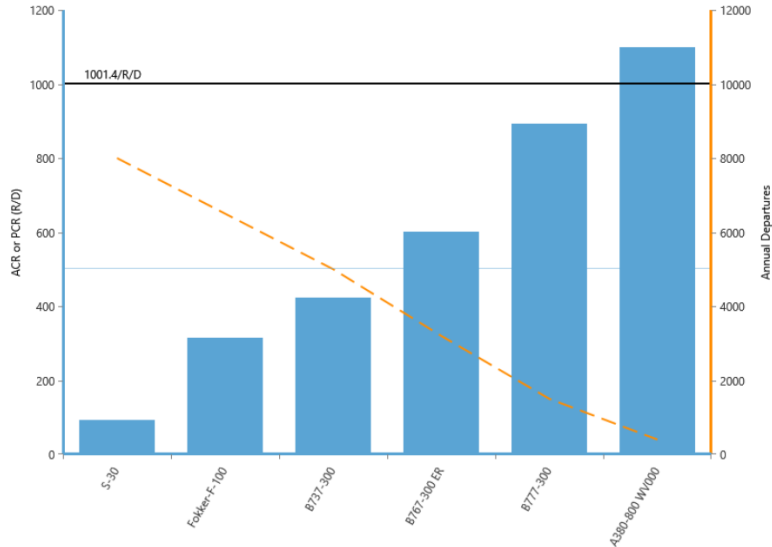
Calculated Life (Years): 29.0 | Total thickness to the top of the subgrade (in.): 29.0

Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (psi)	Percent GW on Gear	Tire Contact Width (in.)	Tire Contact Length (in.)	Tire Contact Area (in. ²)	ACR Thick (in.) (D)	ACR/R/D
5,000	0	100,000	0	0	3.88	199	0.908	11.5	18.4	165.4	12.7	423.4
3,200	0	64,000	0	0.01	3.7	169	0.924	14.0	22.4	245.2	15.2	601.9
400	0	8,000	0	0.29	3.83	211	0.38	14.7	23.5	270.2	20.6	1,106.6
400	0	8,000	2.31	2.34	4.24	211	0.57	14.7	23.5	270.2	0.0	0.0
1,500	0	30,000	0.05	0.83	4.14	188	0.948	13.9	22.3	243.8	18.5	893.9



Overload ACR-PCR

ICAO_WACAF_ACR-PCR: Overload Example



Results Table 2. PCR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft (lbs)	ACR Thick at max. MGW (in.)	PCR Value
1	A380-800 WV000	405	1,145,083	19.8	1022.2

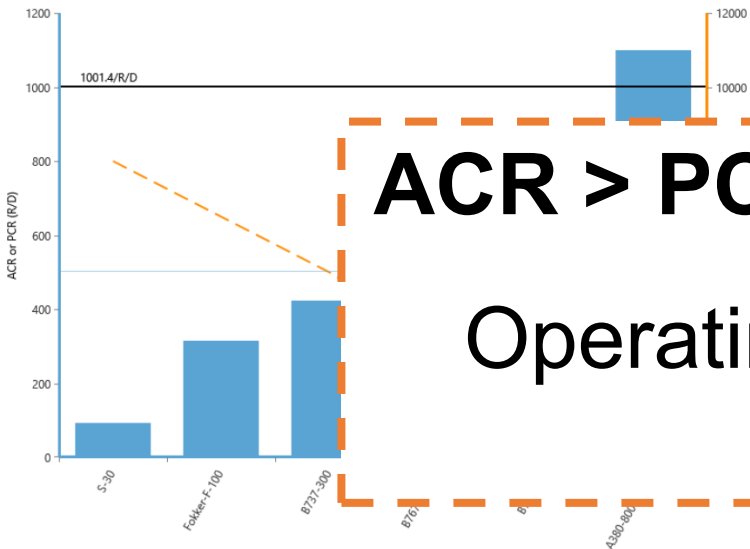
Results Table 3. New Rigid ACR at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight (lbs)	Percent Gross Weight on Main Gear	Tire Pressure (psi)	ACR Thick (in.) (D)	ACR/R/D
1	S-30	30,000	95	75	5.8	92.6
2	Fokker-F-100	98,000	95.6	151	11.0	315.4
3	B737-300	138,499	90.8	199	12.7	423.4
4	B767-300 ER	350,000	92.4	169	15.2	604.0
5	A380-800 WV000	1,199,999	95	211	20.6	1100.6
6	B777-300	579,999	94.8	188	18.5	893.9



Overload ACR-PCR

ICAO_WACAF_ACR-PCR: Overload Example



Results Table 2. PCR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft (lbs)	ACR Thick at max. MGW (in.)	PCR
1	A380-800 WV000	405	1,145,083	19.8	1022.2

ACR > PCR for A380 aircraft

Operating restrictions are necessary

Length	ACR Thick (in.) (D)	ACR/R/D
	5.8	92.6
	11.0	315.4
	12.7	423.4
	15.2	601.0
	20.6	1100.6
	18.5	893.9



Annex 14 on Overloads

20.1.1 ... For those operations in which magnitude of overload and/or the frequency of use do not justify a detailed analysis, the following criteria are suggested:

- a) **for flexible and rigid pavements, occasional movements by aircraft with ACR not exceeding 10 per cent above the reported PCR should not adversely affect the pavement;**
- b) **the annual number of overload movements should not exceed approximately 5 percent of the total annual movements, excluding light aircraft.**

20.1.2 Such overload movements should not normally be permitted on pavement exhibiting signs of distress or failure. Furthermore, overloading should 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. Where overload operations are conducted, the appropriate authority should review the relevant pavement condition regularly, and should also review the criteria for overload operations periodically since excessive repetition of overloads can cause severe shortening of pavement life or require major rehabilitation of pavement.



Overload ACR-PCR

Results Table 2. PCR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft (lbs)	ACR Thick at max. MGW (in.)	PCR/R/D
1	A380-800 WV000	405	1,145,083	19.8	1022.2

Results Table 3. New Rigid ACR at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight (lbs)	Percent Gross Weight on Main Gear	Tire Pressure (psi)	ACR Thick (in.) (D)	ACR/R/D
1	S-30	30,000	95	75	5.8	92.6
2	Fokker-F-100	98,000	95.6	151	11.0	315.4
3	B737-300	138,499	90.8	199	12.7	423.4
4	B767-300 ER	350,000	92.4	169	15.2	601.9
5	A380-800 WV000	1,199,999	95	211	20.6	1100.6
6	B777-300	579,999	94.8	188	18.5	893.9

Check #1

ACR = 1100

PCR = 1022

$ACR \leq 1.1 \times PCR$

1100 ≤ 1124 PASS

Aircraft	Departure Weight, kg	Arrival Weight, kg	Annual Departures
S-30	13,608	10,206	8000
Fokker F-100	44,452	34,019	6500
B737-300	62,822	52,163	5000
B767-300 ER	158,757	131,541	3200
A380-800	544,310	462,664	400
B777-300	263,083	237,682	1500

Check #2

Total Dep. = 10,100

A380-800 = 400

$D_{A380} \leq 0.05 \times D_{Total}$

400 ≤ 505 PASS



FAARFIELD 2.1.1 (Build 12/21/2023)

File Edit View Structure Report PCR Report PCR Graph Airport Master Record

Structure PAVEAIR Access Structure Report PCR Report PCR Graph Airport Master Record

Job Name: ACR-PCR_Workshop_2024 PCR Status: Gear Structure

Structure Name: RigidExample3 Include in Summary Report Add To Batch

Pavement Layers

Pavement Type: HMA Overlay on Rigid

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-401/P-403 HMA Overlay	2.5	200,000		650
P-501 PCC Surface	16.0	4,000,000		
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	24,405		
Subgrade		7,800	103.6	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20 SCB: 80 Percent CDFU: 100 P/TC Ratio: 1

The standard design life for pavement structure is 20 years (1 to 50 allowed).

Results

Calculated Life (Years): Total thickness to the top of the subgrade (in.): 29.5

Traffic

Stored Aircraft Mix: ACRPCR_Workshop_Traffic

Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (lbs)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/TC Ratio	Tire Pressure (psi)	Percent GW on Gear	Tire Contact Width (in.)	Tire Contact Length (in.)	Tire Contact Area (in. ²)	ACI (D)
A300-B4/C4 Std Bogle	365,747	1,500	0	30,000	0	0	0	216	0.95	12.6	20.2	201.0	0.0
A319-100 std	141,978	1,200	0	24,000	0	0	0	173	0.95	12.5	19.9	194.9	0.0
B737-300	140,000	6,000	0	120,000	0	0	0	201	0.95	11.5	18.4	165.4	0.0
B747-400	877,000	1,000	0	20,000	0	0	0	200	0.475	14.4	23.0	260.4	0.0
B747-400 Bellv.	877,000	1,000	0	20,000	0	0	0	200	0.475	14.4	23.0	260.4	0.0

Design Options

Calculate HMA CDF: No

Reduced Cross Section: No

Automatic flexible base design: Yes

Slab Stress Displayed: No

Output file: No

Units: US Customary

Allow Flexible Computation for Thick Overlays on PCC: Yes

Compute ACR for All Subgrade Categories: No

Show Advanced Options

Set as Program Default Reset Default to Initial

Show/Hide Pavement Image

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\Daniel I Offenbacher\OneDrive - Federal Aviation Administration\Documents\My

Change Aircraft Directory

Design Options Notes User Information

ACR-PCR Additional Options



Excess PCR Reporting

- Design thickness was 18 inches
- As-Built current traffic changed since design
- All other factors stayed same

The screenshot displays the FAAFIELD 2.1.2 software interface. A central window titled 'Structure' shows the 'PCR' calculation results for a 'Rigid Pavement Example'. The results are summarized in a table and a status message.

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	18.0	4,000,000		700
P-306 Lean Concrete	5.0	700,000		
P-209 Crushed Aggregate	8.0	25,027		
Subgrade		7,050	95.8	

PCR Calculation of Rigid Pavement Example Completed
Run Time: 582 seconds
PCR = 1370/R/D/W/T

The bottom section of the interface shows a 'Traffic' table with columns for Annual Departures, Annual Growth (%), Total Departures, CDF Contributions, CDF Max for Airplane, P/C Ratio, Tire Pressure (psi), Percent GW on Gear, Tire Contact Width (in.), Tire Contact Length (in.), Tire Contact Area (in.²), ACR Thick (in.), and ACR/R/D. The table lists data for three aircraft types: 5,000, 3,200, and 400.



Excess PCR Reporting

Results Table 2. PCR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft (lbs)	ACR Thick at max. MGW (in.)	PCR/R/D
1	A380-800 WV000	402	1,377,768	22.9	1365.4

Results Table 3. New Rigid ACR at Indicated Gross Weight and Strength

No.	Aircraft Name	Gross Weight (lbs)	Percent Gross Weight on Main Gear	Tire Pressure (psi)	ACR Thick (in.) (D)	ACR/R/D
1	S-30	30,000	95	75	5.8	92.6
2	Fokker-F-100	98,000	95.6	151	11.0	315.4
3	B737-300	138,499	90.8	199	12.7	423.4
4	B767-300 ER	350,000	92.4	169	15.2	601.9
5	A380-800 WV000	1,199,999	95	211	20.6	1100.6
6	B777-300	579,999	94.8	188	18.5	893.9

- Critical ACR = 1100
- PCR = 1370
- Could report PCR 1370
 - Risk is an aircraft with an ACR 1370 may not pose same damage profile as the critical aircraft
- AC 150/5335-5D: Report 25% greater than maximum ACR

B.6.3.4

As there is no upper limit on the ACR-PCR scale, it would be acceptable to publish PCR 1568/F/D, which would have the effect of allowing unrestricted operations of all aircraft. However, such a number has no practical meaning, because no existing or planned aircraft yield ACR numbers in that range. A more conservative alternative would be to arbitrarily select a value 25% larger than the largest ACR of all using aircraft in the list and publish that value as the PCR. In this example, the largest ACR is for the B777-200ER (878/F/D), so publish PCR = 1098/F/D/X/T.



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ACR-PCR Subgrade Categories

Subgrade Categories

- FAARFIELD can run ACR-PCR on all ICAO ACR-PCR subgrade categories

Subgrade Strength Category	Subgrade Support E (Elastic Modulus) psi (MPa)	Represents E (Elastic Modulus) psi (MPa)	Code Designation
High	29008 (200)	$E \geq 21,756$ (≥ 150)	A
Medium	17405 (120)	$E \geq 14,504 < 21,756$ ($\geq 100 < 150$)	B
Low	11603 (80)	$E \geq 8,702 < 14,504$ ($\geq 60 < 100$)	C
Ultra Low	7252 (50)	$E < 8,702$ (< 60)	D

Design Options

Calculate HMA CDF: No

Reduced Cross Section: No

Automatic flexible base design: Yes

Slab Stress Displayed: No

Output file: No

Units: US Customary

Allow Flexible Computation for Thick Overlays on PCC: Yes

Compute ACR for All Subgrade Categories: Yes

Show Advanced Options

Set as Program Default Reset Default to Initial

Show/Hide Pavement Image

Change Pavement Graphics

User Defined Aircraft Directory:
C:\Users\Daniel I Offenbacker
\OneDrive - Federal Aviation
Administration\Documents\My
FAARFIELD User Defined
Aircraft Directory

Change Aircraft Directory

Design Options Notes User Information



ACR-PCR Subgrade Categories

Subgrade Categories

- New table reported in PCR report

No.	Aircraft Name	ACR Thick (in.)(A)	ACR Thick (in.)(B)	ACR Thick (in.)(C)	ACR Thick (in.)(D)	ACR/F/A	ACR/F/B	ACR/F/C	ACR/F/D
1	A300-B4/C4 Std Bogie	16.8	22	27.2	35.7	413.3	456.7	545.9	738.3
2	A319-100 std	14.2	18.6	22	27	280.9	302.5	326.1	364.8
3	B737-300	14.5	18.9	22.5	27.7	291.4	313.4	345.6	388.7
4	B747-400	18	23.2	28.5	37.6	473.8	518.3	607.1	832.9
6	B767-200 ER	16.7	21.7	26.3	34.3	407.4	442.5	507.9	664
7	B777-200 ER	18	22.9	28.1	38.4	469.9	501.6	585.5	878
8	DC8-63/73	15.9	21.3	26.6	35.1	368.6	421.7	520.8	708.6



ACR-PCR P/TC Definition

Passes to Traffic Cycle (P/TC)

- Considers additional operations on same section of runway pavement for a single aircraft
- Two scenarios:
 1. Central Taxiway
 2. No Refueling

Structure

Job Name:

Structure Name: ☒ Include in Summary Report ☐ Add To Batch

Pavement Layers

Pavement Type:

	Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
-->	P-501 PCC Surface	16.0	4,000,000		650
	P-401/P-403 HMA Stabilized	8.0	400,000		
	P-209 Crushed Aggregate	6.0	24,405		
	Subgrade		7,800	103.6	

Design Life (Years):

P/TC Ratio:



ACR-PCR P/TC Definition

Passes to Traffic Cycle (P/TC)

- Central Taxiway

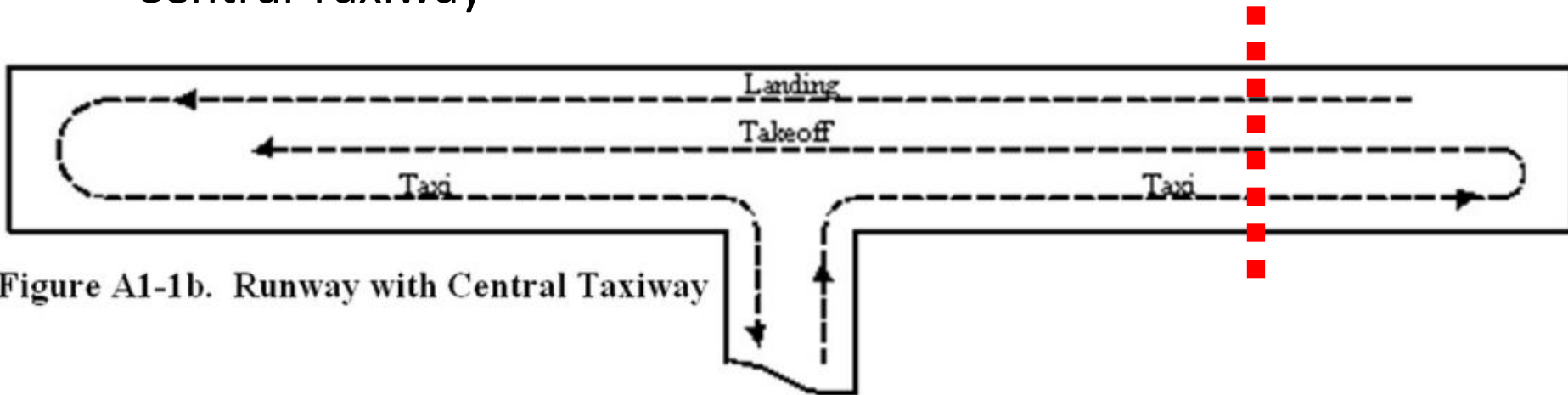


Figure A1-1b. Runway with Central Taxiway



ACR-PCR P/TC Definition



ACR-PCR P/TC Definition

Passes to Traffic Cycle (P/TC)

- AC 150/5335-5D provides guidance on selection of P/TC ratio in **Table A-1**

Taxiway Serving the Runway	P/TC	P/TC
	Fuel Obtained at the Airport (i.e. departure gross weight more than arrival gross weight.)	No Fuel Obtained at the Airport (i.e. departure gross weight same as arrival gross weight.)
Parallel	1	2
Central	2	3



ACR-PCR P/TC Definition

FAARFIELD 2.1.1 (Build 12/21/2023)

New Job Open Job New Structure Save Job Save As Save All Close Job User Defined Aircraft Create Edit Batch Run Selection Select All DeSelect All PAVEAIR Access Help Reset Exit

Explorer

- ICAOWACAF_ACR-PCR
 - Job Information
 - Design Options
 - Summary Report
- Structures
 - Flexible Example
 - Rigid Example
 - Overlay Example
 - Overload Example**
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record

Job Information Structure Structure Report CDF Graph PCR Report PCR Graph Airport Master Record

Structure

Job Name: ICAOWACAF_ACR-PCR PCR Run Status Gear Structure

Structure Name: Overload Example ☒ Include in Summary Report ☐ Add To Batch

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m ³)	R (MPa)
P-501 PCC Surface	440	27,579.04		4.00
P-306 Lean Concrete	127	4,326.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

P/TC Ratio: 1

Traffic

Stored Aircraft Mix: ICAOWACAF_ACR-PCR Workshop Save Aircraft Mix to File Clear All Aircraft from List Remove Selected

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)
S-30	13,608	8,000	0	160,000	0	0	0	517.11
Fokker-E-100	44,452	6,500	0	130,000	0	0	0	1043.63

Design Options

Calculate HMA CDF: No

Reduced Cross Section: No

Automatic flexible base design: Yes

Slab Stress Displayed: No

Output file: No

Units: Metric

Allow Flexible Computation for Thick Overlays on PCC: Yes

Compute ACR for All Subgrade Categories: No

Show Advanced Options

Set as Program Default Reset Default to Initial

Show/Hide Pavement Image

Design Option Notes User Information



Final Remarks

4/29/2022

AC 150/5335-5D
Appendix B

APPENDIX B. PCR DETERMINATION EXAMPLES

B.1 The Using Aircraft Method.

- B.1.1 The Using Aircraft Method for determining PCR is presented in the following steps. This procedure can be used when there is limited knowledge of the existing traffic and runway characteristics. It is also useful when engineering analysis is neither possible nor desired. Because the rating has not been determined rigorously, airport authorities should exercise more care when applying a Using Aircraft PCR than they would with a Technical PCR.
- B.1.2 The basic procedure to arrive at a Using Aircraft PCR is:
1. Determine the ACR for each aircraft in the traffic mix currently using the pavement.
 2. Assign the highest ACR value as the PCR.
- B.1.3 The examples in paragraphs B.2 and B.3 show the steps needed to perform the ACR calculations using ICAO-ACR, and the results. For both flexible and rigid pavement surfaces, the detailed steps are as follows:
1. Assign the pavement surface type as code F or R.
 2. From available records, determine the strength of the pavement subgrade. If the subgrade strength is not known use Medium.

***Contact us with any modifications or issues that arise
while running FAARFIELD 2.1***



Thank You!



Acknowledgments:

FAA Airport Technology R&D Branch:

James Layton, Branch Manager;
Murphy Flynn, Airport Pavement Section
Manager

FAA Airport Engineering Division:

D'Lorah Small, Jeff Crislip, Harold
Muniz-Ruiz

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