

FAARFIELD 2.1 Hands-On Training

Class Exercise 2

Rigid Pavement Design Using FAARFIELD 2.1

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

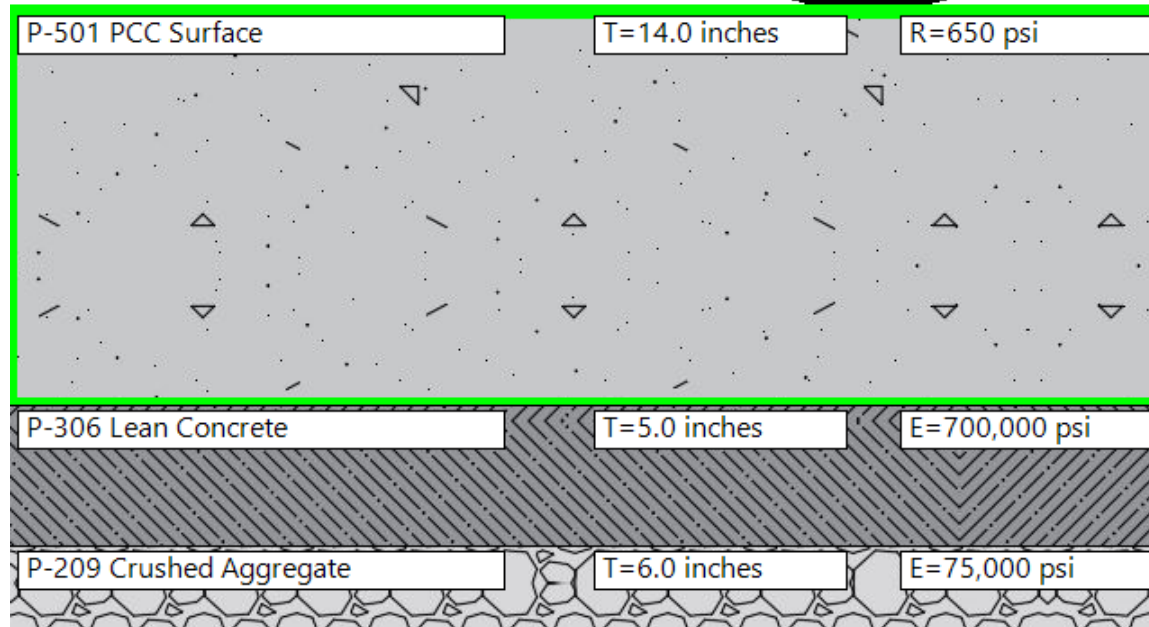
By: Dan Offenbacher, P.E., Ph.D.
Navneet Garg, Ph.D.

Date: June 28, 2026



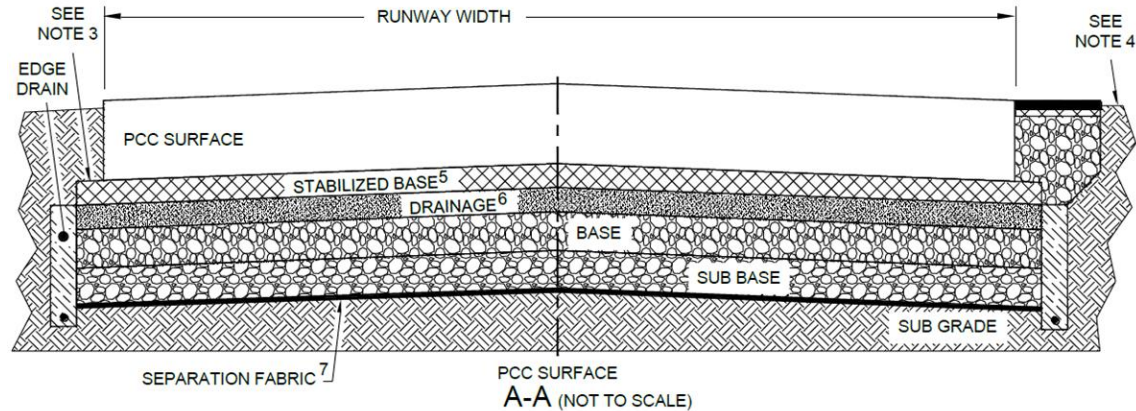
**Federal Aviation
Administration**





Rigid Pavement Design Example Using FAARFIELD 2.1

Typical Rigid Pavement



NOTES:

1. RUNWAY, TAXIWAY AND SHOULDER WIDTHS; TRANSVERSE SLOPES, ETC. PER AC 150/ 5300-13, AIRPORT DESIGN
2. SURFACE, BASE, PCC, ETC. THICKNESS PER AC 150/5320-6.
3. STABILIZED BASE, BASE AND SUBBASE MINIMUM 12 INCHES [30CM] UP TO 36 INCHES [90 CM] BEYOND FULL STRENGTH PAVEMENT.
4. CONSTRUCT A 1.5 INCH [4 CM] DROP BETWEEN PAVED AND UNPAVED SURFACES.
5. WHEN REQUIRED, SEE PARAGRAPH 3.5.
6. LOCATION AND NEED FOR DRAINAGE LAYER AS RECOMMENDED BY GEOTECHNICAL AND PAVEMENT ENGINEER.
7. WHEN RECOMMENDED BY GEOTECHNICAL AND PAVEMENT ENGINEER.

Rigid Pavement Design in FAARFIELD

- **Considers only one mode of failure for rigid pavement, bottom-up cracking of the concrete slab.**
- **Cracking is controlled by limiting the horizontal stress at the bottom of the concrete slab.**
- **The rigid pavement design model does not explicitly consider failure of subbase and subgrade layers.**

Rigid Pavement Failure Model

- FAARFIELD rigid failure model:**

$$DF = \left[\frac{F'_s b d}{(1 - \alpha)(d - b) + F'_s b} \right] \times \log C + \left[\frac{(1 - \alpha)(ad - bc) + bc}{(1 - \alpha)(d - b) + F'_s b} \right]$$

where:

$$SCI = \alpha \times 100 \quad 0 \leq \alpha \leq 1$$

$$DF = \text{design factor} = R/\sigma$$

R = concrete flexural strength (ASTM C78)

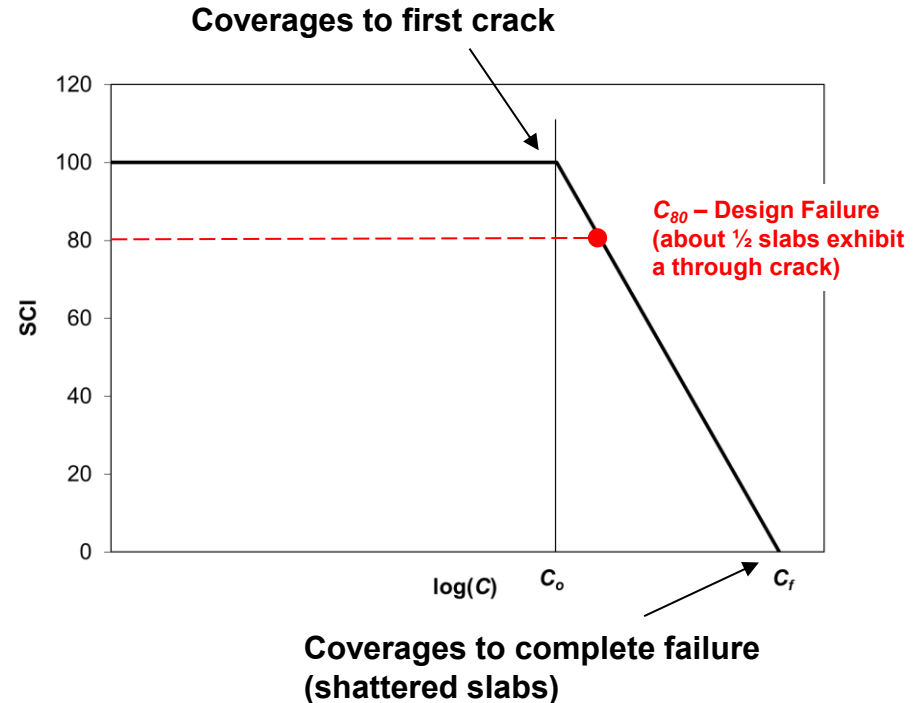
σ = max. computed tensile stress

C = coverages

F'_s = compensation factor for stabilized base

a, b, c, d = parameters determined by full-scale test

- DF is linear in $\log(C)$.**



Concrete Flexural Strength

- **Design flexural strength between 600 and 750 psi (4.14 to 5.17 MPa) is recommended for most airfield applications.**
- **Avoid design flexural strengths higher than 750 psi (5.17 MPa), unless it can be shown that higher strength mixes are produced by normal methods using local materials, i.e., without relying on excessive cement contents or additives likely to negatively impact durability.**
- **The strength used in thickness design is different than the strength used for material acceptance in P-501.**
 - Design strength can be 5% higher than specified 28-day strength.

Subgrade Modulus

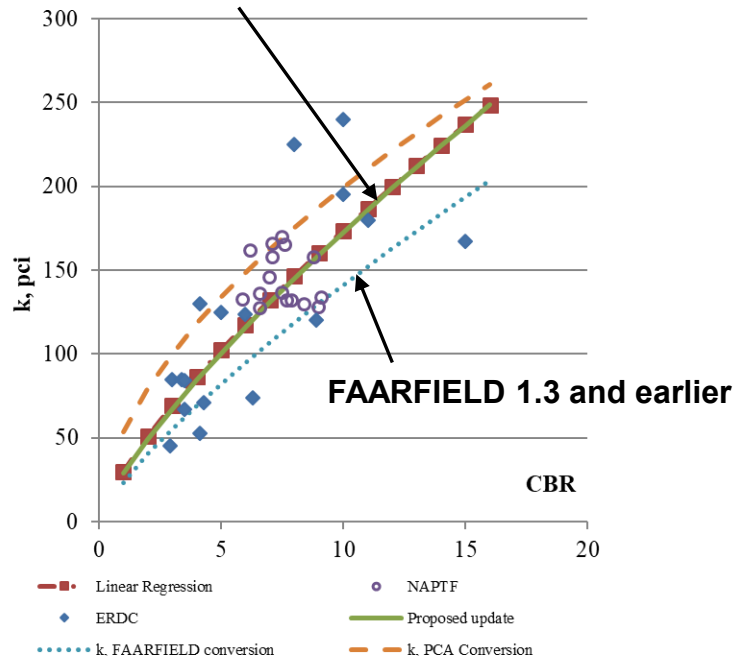
- FAARFIELD automatically converts k to E , and vice-versa.
- The conversion formula implemented in FAARFIELD 2.1 is:

$$k = 28.6926 \times \text{CBR}^{0.7788}$$

where: $\text{CBR} = E / 1500$
(E in psi, and k in psi/inch).

- Compared to the earlier formula:
 - Improved agreement with field correlations
 - less conservative when converting from CBR data.

FAARFIELD 2.1 conversion formula



Rigid Pavement Design Example

A rigid pavement is being designed for a new runway at a commercial airport in Washington, D.C. Based on the information obtained from the Airport Master Plan, the new 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 670 psi.

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

Aircraft	Departure Weight, lbs	Arrival Weight, lbs	Annual Departures
Single-Wheel	30,000	22,500	8,000
Fokker F100	98,000	75,000	6,500
Boeing 737-300	138,500	115,000	5,000
Boeing 767-300 (ER)	350,000	290,000	3,200
Airbus 380-800 WV000	1,200,000	1,020,000	400
Boeing 777-300	580,000	524,000	1,500

Same as flexible example!

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

Boring No.	UCSC Soil Type	Moisture Content, %	Opt. Moisture Content, %	Dry Unit Weight, lb/ft ³	Water Table Depth, ft	CBR, %
B-1	SC	12.2	10.4	129.0	10	10.6
B-2	SC	14.4	12.2	124.6	10	7.2
B-3	SC	16.5	9.6	132.4	8.5	8.4
B-4	CL	15.8	13.5	120.2	6.5	6.3
B-5	CL	17.0	14.5	122.5	8	4.8
B-6	CL	16.2	13.8	120.7	5.5	5.9
B-7	CL	16.8	12.6	124.0	4.5	4.2
B-8	CL	14.2	12.8	128.2	6	6.4
Average:						
Std. Dev.:						

Rigid Pavement Design Example

- 1. What do the soil boring results tell us about the in situ soil properties?
What subgrade support value do you recommend for design?**
- 2. What type and thickness of base/subbase materials do you recommend?
Are positive drainage features required?**
- 3. What flexural strength of concrete would you use for the design?**
- 4. Should the pavement be designed for aircraft arrival or departure weights?
What is the required PCC slab thickness for the runway? What is the most demanding aircraft?**
- 5. Perform a sensitivity analysis on the following variables:**
 - Average annual departures of most demanding aircraft (+/- 20 percent of departures).
 - Departure weight of the most demanding aircraft (+/- 10 percent of weight).
 - Subgrade modulus (+/- 10 percent of modulus).
 - Concrete Flexural Strength (+/- 10 percent of R).

Rigid Pavement Design Example

1. What do the soil boring results tell us about the in situ soil properties? What subgrade support value do you recommend for design?

Mean CBR – 6.7 Standard Deviation – 2.04

Design CBR – 4.7 $E_{SG} = 7050$ psi

2. What type and thickness of base/subbase materials do you recommend? Are positive drainage features required?
3. What flexural strength of concrete would you use for the design?

AC 150/5320-6G allows 5 percent above specified 28-day strength for design.

Given 28-day strength = 670 psi, the allowable design strength is $1.05 \times 670 = 703.5$ psi.

Use 700 psi in the FAARFIELD design.

4. Should the pavement be designed for aircraft arrival or departure weights? What is the required PCC slab thickness for the runway? What is the most demanding aircraft?

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

Boring No.	UCSC Soil Type	Moisture Content, %	Opt. Moisture Content, %	Dry Unit Weight, lb/ft ³	Water Table Depth, ft	CBR, %
B-1	SC	12.2	10.4	129.0	10	10.6
B-2	SC	14.4	12.2	124.6	10	7.2
B-3	SC	16.5	9.6	132.4	8.5	8.4
B-4	CL	15.8	13.5	120.2	6.5	6.3
B-5	CL	17.0	14.5	122.5	8	4.8
B-6	CL	16.2	13.8	120.7	5.5	5.9
B-7	CL	16.8	12.6	124.0	4.5	4.2
B-8	CL	14.2	12.8	128.2	6	6.4
Average:						
Std. Dev.:						

Creating/Naming a Section

Click on "New Section"

Enter Section Name"

FAARFIELD 2.1.2 (Build 06/03/2026)

File Edit View Options Help

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

Explorer

- New Job 1
 - Job Information
 - Design Options
 - Summary Report
 - Structures
 - New Structure 1
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record
- New Job 2
 - Job Information
 - Design Options
 - Summary Report
 - Structures
 - New Structure 1
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record

Structure

Job Name: New Job 2 Thickness Design Run Status Gear Structure

Structure Name: Rigid Pavement Example Include in Summary Report Add To Batch

Pavement Layers

Pavement Type:

Material	Thickness (in.)	E (psi)
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Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 29.0

Traffic

Stored Aircraft Mix 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)
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User Information

Current User: PAVEAIR Login

Software Information

Installed Version: 2.1.2
Available Version: 2.1.2

Aircraft Library Information

Installed Version: 1.2.4
Available Version: 1.2.4

Download Aircraft Library

Explorer Aircraft Material

Notes User Information

Select Structure

Select "Thickness Design"

Select Pavement Type as "New Rigid"

Default pavement structure details in table

Default pavement life (20 years)

Default pavement structure for "New Rigid" type

FAARFIELD 2.1.2 (Build 10/04/2019)

File Edit Batch Run Selection Select All DeSelect All PAVEAIR Access

Explorer

- New Job 1
 - Job Information
 - Design Options
 - Summary Report
 - Structures
 - New Structure 1
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record
 - New Job 2
 - Job Information
 - Design Options
 - Summary Report
 - Structures
 - Rigid Pavement Example
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record

Structure

Job Name: New Job 2 Thickness Design Run Status Gear Structure

Structure Name: Rigid Pavement Example 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	14.0	4,000,000	650	
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		15,000	172.4	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 25.0

Copy Structure to Clipboard

Traffic

Stored Aircraft Mix 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)
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User Information

Current User: PAVEAIR Login

Software Information

Installed Version: 2.1.2 Available Version: 2.1.2

Aircraft Library Information

Installed Version: 1.2.4 Available Version: 1.2.4

Download Aircraft Library

Notes User Information

Design Options

Click "Design Options"

"Output File"

"Units"

The screenshot displays the FAARFIELD 2.1.2 software interface. The 'Design Options' panel is active, showing various settings for a pavement design. The 'Structure' panel on the left lists the design layers: P-501 PCC Surface, P-401/P-403 HMA Stabilized, P-209 Crushed Aggregate, and Subgrade. The 'Traffic' panel at the bottom shows a table of aircraft data. The 'Design Options' panel on the right contains settings for HMA CDF, Reduced Cross Section, Automatic flexible base design, Slab Stress Displayed, Output file, Units, Allow Flexible Computation for Thick Overlays on PCC, Compute ACR for All Subgrade Categories, Show Advanced Options, Set as Program Default, Reset Default to Initial, Show/Hide Pavement Image, Change Pavement Graphics, and User Defined Aircraft Directory.

Structure

Job Name: New Job 1 Thickness Design Run Status Gear Structure

Structure Name: Rigid Pavement Example 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	14.0	4,000,000		650
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		15,000	172.4	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 25.0

Copy Structure to Clipboard

Traffic

Stored Aircraft Mix 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)
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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 FAARFIELD

Change Aircraft Directory

Design Options Notes User Information

Materials Library – Layer Types

FAARFIELD 2.1.2 (Build 06/03/2026)

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

Material

- General
 - User Defined
 - Subgrade
- Aggregate
 - P-154 Uncrushed Aggregate
 - P-208 Crushed Aggregate
 - P-209 Crushed Aggregate
 - P-211 Lime Rock
 - P-219 Recycled Concrete Aggregate
- P-401/P-403 HMA
 - P-401/P-403 HMA Surface
 - P-401/P-403 HMA Overlay
- P-501 PCC
 - P-501 PCC Surface
 - P-501 PCC Overlay (unbonded)
 - P-501 PCC Overlay on Flexible
- Stabilized
 - P-301 Soil Cement Base
 - P-304 Cement Treated Base
 - P-306 Lean Concrete
 - P-401/P-403 HMA Stabilized
 - Variable (flexible)
 - Variable (rigid)

Structure

Job Name: New Job 1 Thickness Design Run Status Gear Structure

Structure Name: Rigid Pavement Example 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	14.0	4,000,000		650
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		15,000	172.4	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 25.0

Traffic

Stored Aircraft Mix 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)
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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 J. Offenbacher\OneDrive - Federal Aviation Administration\Documents\My Pavement Design

Change Aircraft Directory

Design Options Notes User Information

Click "Material" tab to open materials library

Aircraft Library

Click "Aircraft" tab to open aircraft library

The screenshot displays the FAARFIELD 2.1.2 software interface. The left sidebar shows the 'Aircraft' tab selected, revealing the 'FAARFIELD Aircraft Library' with a list of aircraft types (SWL-2, SWL-5, SWL-10, SWL-50, S-3, S-5, S-10, S-12.5, S-15, S-20, S-25, S-30, S-30 HTP, S-35 HTP, S-40 HTP, S-45, S-50, S-60). The main window is divided into several panels:

- Structure Panel:** Contains fields for 'Job Name' (New Job 1), 'Thickness Design' dropdown, and 'Run' button. Below, 'Structure Name' is 'Rigid Pavement Example', with checkboxes for 'Include in Summary Report' and 'Add To Batch'. The 'Pavement Layers' section shows a 'New Rigid' type. A table lists the layers:

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	14.0	4,000,000		650
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		15,000	172.4	

Buttons for 'Select As The Design Layer' and 'Delete Selected Layer' are present. Below the table, 'Design Life (Years)' is set to 20, with a note: 'The standard design life for pavement structure is 20 years (1 to 50 allowed)'. The 'Results' section shows 'Calculated Life (Years)' and 'Total thickness to the top of the subgrade (in.): 25.0'. A 'Copy Structure to Clipboard' button is at the bottom.- Traffic Panel:** Features a 'Stored Aircraft Mix' dropdown, 'Save Aircraft Mix to File', 'Clear All Aircraft from List', 'Remove Selected Aircraft from Structure', and 'Delete Aircraft Mix File' buttons. A table with columns for '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.)', and 'Tire Contact Area (in.^2)' is shown.
- Design Options Panel:** Includes settings for '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), and 'Compute ACR for All Subgrade Categories' (No). Buttons for 'Show Advanced Options', 'Set as Program Default', 'Reset Default to Initial', 'Show/Hide Pavement Image', and 'Change Pavement Graphics' are also present.
- User Defined Aircraft Directory:** Shows the path 'C:\Users\Daniel I. Offenbacher\OneDrive - Federal Aviation Administration\Documents\My FAARFIELD\Aircraft' and a 'Change Aircraft Directory' button.

Aircraft Library –

Completely reorganized and updated for the FAARFIELD 2.1 release

Aircraft	Aircraft	Aircraft	Aircraft	Aircraft	Aircraft	Aircraft	Aircraft
FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group	FAARFIELD Aircraft Group
Generic	Generic	Generic	Generic	Generic	Generic	Generic	Generic
Airbus	Airbus	Airbus	Airbus	Airbus	Airbus	Airbus	Airbus
Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing	Boeing
McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas	McDonnell Douglas
Other Large Jet	Other Large Jet	Other Large Jet	Other Large Jet	Other Large Jet	Other Large Jet	Other Large Jet	Other Large Jet
Regional/Commuter	Regional/Commuter	Regional/Commuter	Regional/Commuter	Regional/Commuter	Regional/Commuter	Regional/Commuter	Regional/Commuter
General Aviation	General Aviation	General Aviation	General Aviation	General Aviation	General Aviation	General Aviation	General Aviation
Military	Military	Military	Military	Military	Military	Military	Military
Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles	Non-Airplane Vehicles
External Library	External Library	External Library	External Library	External Library	External Library	External Library	External Library
FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library	FAARFIELD Aircraft Library
SWL-2	A300-B2	B707-320C	DC3	An-124	BAe 146-300/300QC/300QT	Beechcraft Baron 55	A400M LH
SWL-5	A300-B2K	B717-200 HGW	DC8-63/73	An-225	BeechJet-400/400A	Beechcraft Bonanza F33A	A400M LN1
SWL-10	A300-B4/C4 Std Bogie	B727-100C Alternate	DC9-32	Bombardier CS100	Bombardier CL-604/605	Beechcraft King Air 300	A400M TLL1
SWL-50	A300-B4/C4 LGA Bogie	B727-200 Advanced Basic	DC9-51	COMAC C919	Cessna Citation II/Bravo C550	Beechcraft King Air 350	A400M TLL2
S-3	A300-600 Std Bogie	B727-200 Advanced Option	DC/MD-10-10/10F	COMAC C919 ER	Cessna Citation V	Beechcraft King Air B100	B-52
S-5	A300-600 LGA Bogie	B737-100	DC/MD-10-30/30F/40	Fokker-F-100	Cessna Citation VI/VII	Beechcraft King Air B200	C-5
S-10	A310-200	B737-200 Advanced QC	MD-11	Fokker-F-28-1000/2000	Cessna Citation X	Beechcraft King Air C90	C-17A
S-12.5	A310-300	B737-200	MD-83	F-28-3000/4000/6000	CRJ100/200	Cessna 172 Skyhawk	C-123
S-15	A318-100 std	B737-300	MD-90-30 ER	IL-62	CRJ100ER/200ER	Cessna 182 Skylane	C-130
S-20	A318-100 opt	B737-400		IL-76T	CRJ100LR/200LR	Cessna 206 Stationair	C-130-57
S-25	A319-100 std	B737-500		IL-86	CRJ700	Cessna 208B Grand Caravan	C-130-70
S-30	A319-100 opt	B737-600		L-100-20	CRJ900	Cessna 414/414A Chancellor	F-15C
S-30 HTP	A319neo	B737-700		L-1011	CRJ1000	Cessna C210 Centurion	F-16C
S-35 HTP	A320-200 std	B737-800		TU-134A	Dassault Falcon 50/50EX	Cessna C441 Conquest II	F/A-18C
S-40 HTP	A320-200 opt	B737-900		TU-154B	Dassault Falcon 900B/C	Cessna Citation M2 CS25	KC-10
S-45	A320-200 WV000 Bogie	B737-900 ER					P-3C

Creating Aircraft Traffic Mix

The screenshot displays the FAARFIELD 2.1.2 software interface. The 'Structure' panel is active, showing a 'Rigid Pavement Example' with a 'New Rigid' pavement type. A table lists materials and their properties:

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	14.0	4,000,000		650
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		15,000	172.4	

The 'Traffic' panel is also visible, showing a table of aircraft data:

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)
Fokker-F-100	98,000	6,500	0	130,000	0	0	0	151	0.95	11.1	17.7	153.8
B737-300	138,499	5,000	0	100,000	0	0	0	199	0.95	11.5	18.4	165.4
B767-300 ER	350,000	3,200	0	64,000	0	0	0	169	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0	0	211	0.38	14.7	23.5	270.0
A380-800 WV000 Belly	1,199,999	400	0	8,000	0	0	0	211	0.57	14.7	23.5	270.0
B777-300	579,999	1,500	0	30,000	0	0	0	188	0.95	13.9	22.3	243.8

Annotations highlight two methods for adding aircraft to the traffic table:

- Pick aircraft from the library. Double click on the aircraft name or drag/drop.
- Select a stored aircraft mix from the drop-down.

A second annotation points to the 'Stored Aircraft Mix' dropdown in the Traffic panel, stating: 'Select an aircraft to display gear geometry.'

Modify Default Layer Properties

FAARFIELD 2.1.2 (Build 06/03/2026)

Structure

Job Name: New Job 1 Thickness Design Run

Structure Name: Rigid Pavement Example Include in Summary Report Add To Bat

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	14.0	4,000,000		650
P-401/P-403 HMA Stabilized	5.0	400,000		
P-209 Crushed Aggregate	6.0	75,000		
Subgrade		7,050	95.8	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 25.0

Traffic

Stored Aircraft Mix: ACR-PCR Workshop 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	CDI Contributions	CDI 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)
S-30	30,000	8,000	0	160,000	0	0	0	75	0.95	12.3	19.7	150.0
Fokker-T-100	96,000	6,500	0	130,000	0	0	0	151	0.95	11.1	17.7	153.8
B737-300	138,499	5,000	0	100,000	0	0	0	199	0.95	11.5	18.4	165.4
B767-300 ER	350,000	3,200	0	64,000	0	0	0	169	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0	0	211	0.38	14.7	23.5	270.0
A380-800 WV000 Belly	1,199,999	400	0	8,000	0	0	0	211	0.57	14.7	23.5	270.0

Change Pavement Graphics

User Defined Aircraft Directory:

C:\Users\Daniel I. Offenbacher\OneDrive - Federal Aviation Administration\Documents\My FAARFIELD

Change Aircraft Directory

Design Options Notes User Information

- Enter the modulus value based on design CBR (7050 psi).
- FAARFIELD computes an equivalent k-value using the conversion formula.

Modify Default Layer Properties

The screenshot displays the FAARFIELD 2.1.2 (Build 06/03/2026) interface. The **Structure** panel shows the following layer properties:

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	14.0	4,000,000		650
P-306 Lean Concrete	5.0	700,000		
P-209 Crushed Aggregate	8.0	75,000		
Subgrade			95.8	

The **Traffic** panel shows the **Stored Aircraft Mix** table:

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)
S-30	30,000	8,000	0	160,000	0	0	0	75	0.95	12.3	19.7	1500
Fokker-T-100	96,000	6,500	0	130,000	0	0	0	151	0.95	11.1	17.7	153.8
B737-300	138,499	5,000	0	100,000	0	0	0	199	0.95	11.5	18.4	165.4
B767-300 ER	350,000	3,200	0	64,000	0	0	0	169	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0	0	211	0.38	14.7	23.5	270.0
A380-800 WV000 Belly	1,199,999	400	0	8,000	0	0	0	211	0.57	14.7	23.5	270.0

A callout box points to the **P-306 Lean Concrete** and **P-209 Crushed Aggregate** layers with the text: "Select Base & Subbase type and thickness".

Modify Default Layer Properties

Change flexural strength from default value to R =700 psi (as determined on a previous slide).

Structure

Job Name: New Job 1 Thickness Design Run

Structure Name: Rigid Pavement Example Include in Summary Report Add To Bat

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	14.0	4,000,000		700
P-306 Lean Concrete	5.0	700,000		
P-209 Crushed Aggregate	8.0	75,000		
Subgrade			95.8	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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.): 27.0

Traffic

Stored Aircraft Mix: ACR-PCR Workshop 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)
S-30	30,000	8,000	0	160,000	0	0	0	75	0.95	12.3	19.7	150.0
Fokker-T-100	96,000	6,500	0	130,000	0	0	0	151	0.95	11.1	17.7	153.8
8737-300	138,499	5,000	0	100,000	0	0	0	199	0.95	11.5	18.4	165.4
8767-300 ER	350,000	3,200	0	64,000	0	0	0	169	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0	0	211	0.38	14.7	23.5	270.0
A380-800 WV000 Belly	1,199,999	400	0	8,000	0	0	0	211	0.57	14.7	23.5	270.0

User Defined Aircraft Directory:

C:\Users\Daniel I. Offenbacher\OneDrive - Federal Aviation Administration\Documents\My FAARFIELD Files\Aircraft Directory

Change Aircraft Directory

Design Options Notes User Information

Perform Pavement Thickness Design

The screenshot displays the FAARFIELD 2.1.2 software interface. The main window is divided into several sections:

- Structure Section:**
 - Job Name: New Job 1
 - Structure Name: New Structure 1
 - Pavement Type: New Rigid
 - Material List:

Material	Thickness (in.)	E (psi)	k (pci)	R (psi)
P-501 PCC Surface	16.0	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	
 - Design Life (Years): 20
 - Calculated Life (Years): [Blank]
 - Total thickness to the top of the subgrade (in.): 29.0
- Traffic Section:**
 - Stored Aircraft Mix: ACR-PCR Workshop
 - Table of Aircraft Data:

Annotations:

- A box highlights the "Run" button in the Structure section.
- A text box states: "Click 'Run' to start pavement thickness design. While the design is running, the clock will advance. Rigid designs take longer than flexible designs. Be patient!"
- A label "Running Time : 00:00:11" points to the right side of the interface.

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)
S-30	30,000	8,000	0	160,000	0	0	6.33	75	0.95	12.3	19.7	190.0
Fokker-F-100	98,000	6,500	0	130,000	0	0	3.72	151	0.95	11.1	17.7	153.8
8737-300	138,499	5,000	0	100,000	0	0	3.8	199	0.95	11.5	18.4	165.4
8767-300 ER	350,000	3,200	0	64,000	0	0	3.65	169	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0.11	3.83	211	0.38	14.7	23.5	270.2
A380-800 WV000 Belly	1,199,999	400	0	8,000	0.98	0.99	4.24	211	0.57	14.7	23.5	270.2

Completed Pavement Thickness Design

Structure

Job Name: New Job 1 Thickness Design Run Status Gear Structure

Structure Name: New Structure 1 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		700
P-306 Lean Concrete	5.0	4,000,000		
P-209 Crushed Aggregate	8.0	5,027		
Subgrade			95.8	

Design Life (Years): 20

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.): 29.0

Traffic

Stored Aircraft Mix: ACR-PCR Workshop 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 on Gear	Tire Contact Width (in.)	Tire Contact Length (in.)	Tire Contact Area (in. ²)
S-30	30,000	8,000	0	160,000	0	0	6.33	75	0.95	12.3	19.7	190.0
Fokker F-100	96,000	6,500	0	130,000	0	0	3.72	51	0.95	11.1	17.7	153.8
B737-300	138,499	5,000	0	100,000	0	0	3.8	99	0.95	11.5	18.4	165.4
B767-300 ER	350,000	3,200	0	64,000	0	0	3.65	69	0.95	14.0	22.4	245.2
A380-800 WV000	1,199,999	400	0	8,000	0	0.11	3.83	111	0.38	14.7	23.5	270.2
A380-800 WV000 Belly	1,199,999	400	0	8,000	0.98	0.99	4.24	111	0.57	14.7	23.5	270.2

Design Parameters:

- Design thickness is 16.0 in. (= 40.5 cm)
- Round to the nearest 0.5 in or 1 cm.
- Specify as 16 in. (or 40 cm)

Design Options:

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 Pavement Design A Change Aircraft Directory

Design Options Notes User Information

P-501 PCC Surface
Thickness was designed

P/C Ratio for each aircraft

CDF max. for aircraft

CDF contribution
of each aircraft

CDF Chart

PORT FILED C:\E:\WORK\WORK\WORK

New Job Open Job New Structure Save Job Save As Save All Close Job User Defined Aircraft Create Edit Batch Run Sele

plorer

New Job 1

- Job Information
- Design Options
- Summary Report
- Structures
 - New Structure 1
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record

New Job 2

- Job Information
- Design Options
- Summary Report
- Structures
 - Rigid Pavement Example
 - Structure Report
 - CDF Graph
 - PCR Report
 - PCR Graph
 - Airport Master Record

Structure CDF Graph

Structure

Job Name: New Job 2 Thickness Design Run

Structure Name: Rigid Pavement Example ☒ Include in Summary Report ☐ Add To

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (in.)	E (psi)	k (pci)
P-501 PCC Surface	16.0	4,000,000	
P-306 Lean Concrete	5.0	700,000	
P-209 Crushed Aggregate	8.0	25,027	
Subgrade		7,050	95.8

Select As The Design Layer Delete Selected La

Design Life (Years): 20

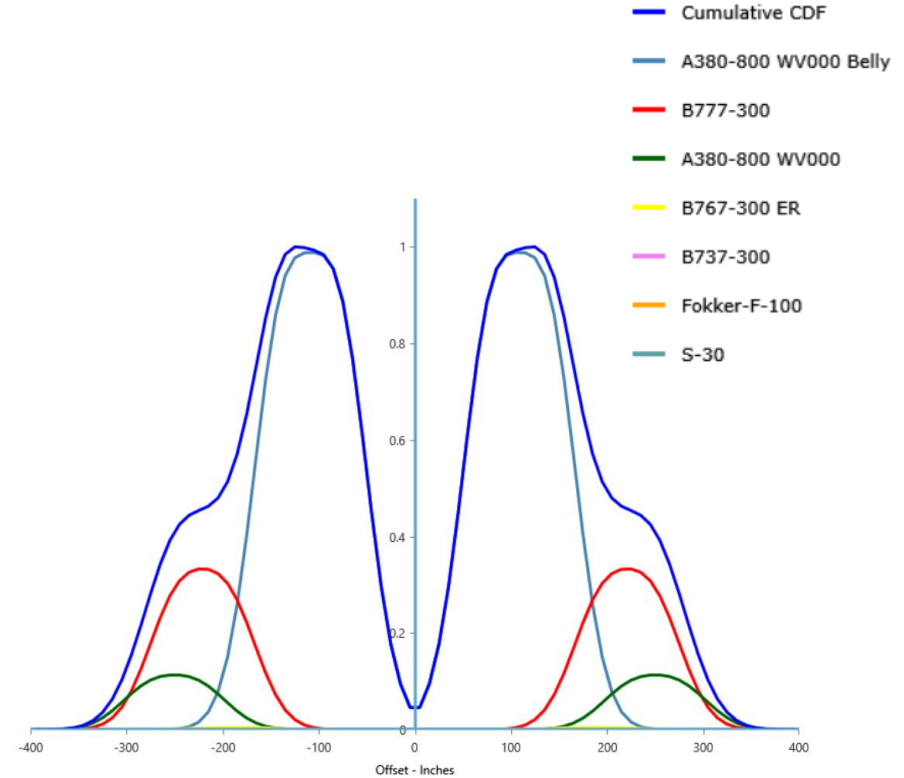
The standard design life for pavement structure is 20 years (1 to 50 allowed).

Results

Calculated Life (Years): Total thickness to the top of the subgrade (in.): 2

Traffic

Stored Aircraft Mix ACR-PCR Workshop Save Aircraft Mix to File



Rigid Pavement Example – Results

1. What do the soil boring results tell us about the in situ soil properties? What subgrade support value do you recommend for design?
Mean CBR = 6.7 Standard Deviation = 2.04 Design CBR = 4.7 $E_{SG} = 7050$ psi
2. What type and thickness of base/subbase materials do you recommend? Are positive drainage features required?
3. What flexural strength of concrete would you use for the design?
**AC 150/5320-6G allows 5 percent above specified 28-day strength for design.
Given 28-day strength = 670 psi, the allowable design strength = $1.05 \times 670 = 703.5$ psi.
Use $R = 700$ psi in the FAARFIELD design.**
4. Should the pavement be designed for aircraft arrival or departure weights? What is the required PCC slab thickness for the runway? What is the most demanding aircraft?
**For the given inputs, FAARFIELD 2.1 gives a slab thickness 16.0 in.
The most demanding aircraft is the Airbus 380-800, for which the belly gear (6-wheels) contributes 98% of the CDF on the critical strip.**

Structure Report

The screenshot displays the FAARFIELD 2.1.2 software interface. The Explorer panel on the left shows a tree view of the project structure. A red arrow points to the 'Structure Report' option under the 'Rigid Pavement Example' folder. The main window displays the 'Federal Aviation Administration FAARFIELD 2.1 Structure Report' for 'Job Name: New Job 2'. The report includes job information, analysis type, and design parameters. It also contains two tables: 'Pavement Structure Information by Layer' and 'Airplane Information'. The Design Options panel on the right shows various settings for the analysis.

Federal Aviation Administration FAARFIELD 2.1 Structure Report
FAARFIELD 2.1.2 (Build 06/03/2026)

Job Name: New Job 2
Structure: Rigid Pavement Example
Analysis Type: New Rigid
Last Run: Thickness Design 2026-06-27 22:45:09
Design Life = 20 Years
Total thickness to the top of the subgrade = 29.0in.

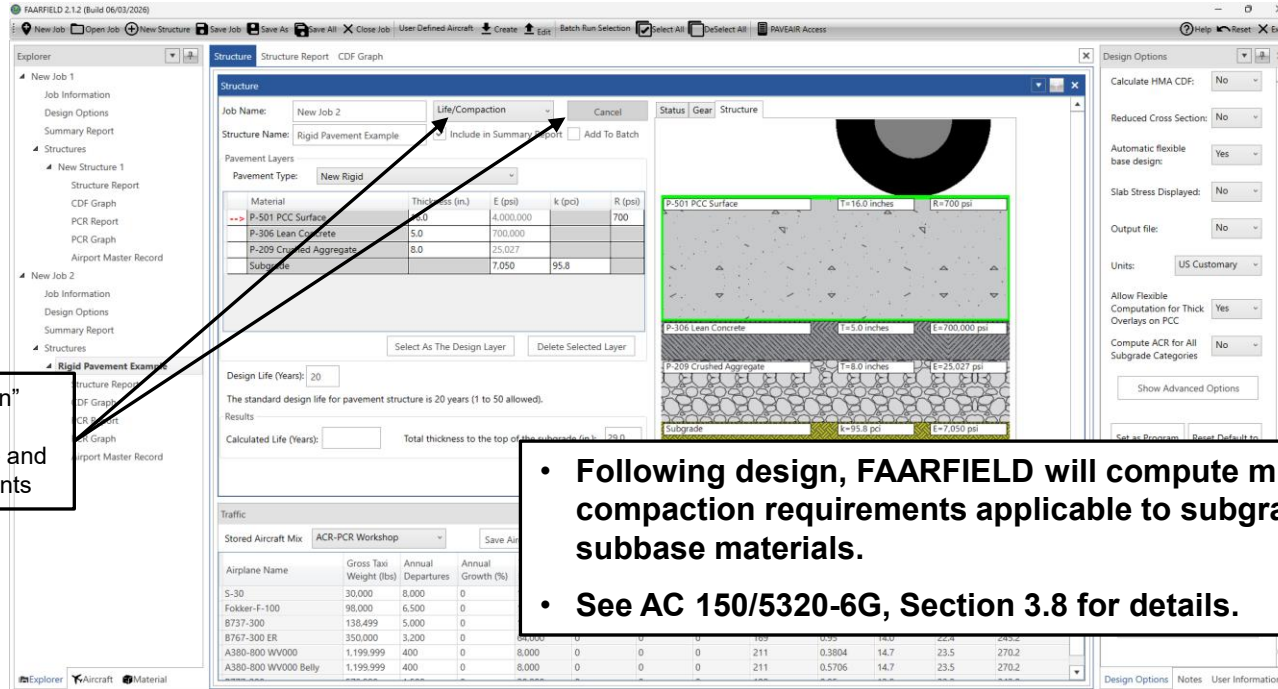
Pavement Structure Information by Layer

No.	Type	Thickness (in.)	Modulus (psi)	k (pci)	Poisson's Ratio	Strength R (psi)
1	P-501 PCC Surface	16.0	4,000,000	0	0.15	700
2	P-306 Lean Concrete	5.0	700,000	0	0.2	0
3	P-209 Crushed Aggregate	8.0	25,027	0	0.35	0
4	Subgrade	0	7,050	95.8	0.4	0

Airplane Information

No.	Name	Gross Wt. (lbs)	Annual Departures	% Annual Growth
1	S-30	30,000	8,000	0
2	Fokker-F-100	98,000	6,500	0
3	B737-300	138,499	5,000	0
4	B767-300 ER	350,000	3,200	0

Life/Compaction



Select "Life/Compaction"

Click "Run" to start Life and Compaction requirements

- Following design, FAARFIELD will compute minimum compaction requirements applicable to subgrade and subbase materials.
- See AC 150/5320-6G, Section 3.8 for details.

Life/Compaction

Pavement Life Results

Status Gear Structure

New Rigid Analysis of Rigid Pavement Example Completed
Run Time: 154 seconds
%CDFU = 195.07; PCC CDF = 1.00; Life = 20.0 yrs

Structure

Job Name: New Job 2 Life/Compaction Run

Structure Name: Rigid Pavement Example 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		700
P-306 Lean Concrete	5.0	700,000		
P-209 Crushed Aggregate	8.0	25,027		
Subgrade		7,050		

Select As The Design Layer

Design Life (Years): 20

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

Results

Calculated Life (Years): 20.0 Total thickness to the top of the subgrade: 29.0 in.

Traffic

Stored Aircraft Mix: ACR-PR Workshop Save Aircraft

Airplane Name	Gross Taxi Weight (lbs)	Annual Departures	Annual Growth (%)	Total Design Life (Years)
S-30	30,000	8,000	0	16
Fokker F-100	98,000	6,500	0	13
B737-300	138,499	5,000	0	10
B767-300 ER	350,000	3,200	0	64,000
A380-800 WW000	1,199,999	400	0	8,000
A380-800 WW000 Belly	1,199,999	400	0	8,000

Change Aircraft Directory

Design Options Notes User Information

Compaction Requirements

Subgrade Compaction Requirements

NonCohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (in.)	Depth of compaction from top of subgrade (in.)	Critical Airplane for Compaction
100	0 - 15	--	A380-800 WV000 Belly
95	15 - 23	--	A380-800 WV000 Belly
90	23 - 125	0 - 96	A380-800 WV000 Belly
85	125 - 216	96 - 187	A380-800 WV000 Belly

Cohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (in.)	Depth of compaction from top of subgrade (in.)	Critical Airplane for Compaction
95	0 - 14	--	A380-800 WV000 Belly
90	14 - 18	--	A380-800 WV000 Belly
85	18 - 58	0 - 29	A380-800 WV000 Belly
80	58 - 121	29 - 92	A380-800 WV000 Belly

Subgrade Compaction Notes:

- Noncohesive soils, for the purpose of determining compaction control, are those with a plasticity index (PI) less than 3.
- Tabulated values indicate depth ranges within which densities should equal or exceed the indicated percentage of the maximum dry density as specified in Item P-152.
- Maximum dry density is determined using ASTM Method D 1557.
- The subgrade in cut areas should have natural densities shown or should (a) be compacted from the surface to achieve the required densities, (b) be removed and replaced at the densities shown, or (c) when economics and grades permit, be covered with sufficient select or subbase material so that the uncompacted subgrade is at a depth where the in-place densities are satisfactory.
- For swelling soils refer to AC 150/5320-6F paragraph 3.10.

NOTE:

- Compaction requirements are available in the Section Report.
- Two tables apply to:
 - (1) Noncohesive soils ($PI < 3$)
 - (2) Cohesive soils
- Maximum dry density determined either by modified Proctor (if aircraft gross weight > 60,000 lbs.), or standard Proctor (otherwise).
- Up to the engineer to correctly apply the information in these tables.

Rigid Pavement Design Example - Sensitivities

Perform a sensitivity analysis on the following variables:

- Average annual departures of most demanding aircraft (+/- 20 percent of departures).
A380-800 annual departures: 480 / 320
- Departure weight of the most demanding aircraft (+/- 10 percent of weight).
A380-800 GW: 1,320,000 / 1,080,000 lbs.
- Subgrade modulus (+/- 10 percent of modulus).
E = 7,755 / 6,345 psi
- Concrete Flexural Strength (+/- 10 percent of R).
R = 770 / 630 psi

Sensitivity Analysis:

Condition	Design Thickness, in	Sensitivity
Basic Design	15.9	
+20% A380 Departures -20% A380 Departures	16.1 15.8	$S_{Dep,t} = \frac{0.3}{160} \times \frac{400}{15.9} = 0.047$
+10% A380 Gross Weight -10% A380 Gross Weight	17.4 15.3	$S_{GW,t} = \frac{2.1}{240000} \times \frac{1200000}{15.9} = 0.660$
+10% Subgrade E -10% Subgrade E	15.7 16.2	$S_{E,t} = \frac{-0.50}{1410} \times \frac{7050}{15.9} = -0.157$
+10% R -10% R	14.5 17.6	$S_{R,t} = \frac{-3.1}{140} \times \frac{700}{15.9} = -0.975$

The thickness design is most sensitive to concrete strength, followed by gross weight of the controlling aircraft. The FAARFIELD rigid design is insensitive to small changes in the number of aircraft departures.

Thank You!

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