

# ***ICAO AERODROME PAVEMENT WORKSHOP***

## **Design Examples Using FAARFIELD 2.1**

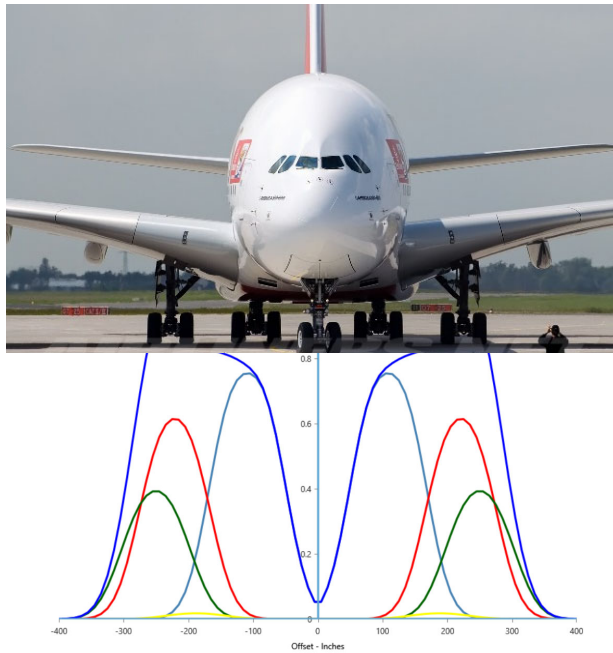
**Presented to:** ICAO Aerodrome Pavement Workshop  
Bangkok, Thailand

**By:** Harold Muniz  
David R. Brill, P.E., Ph.D.

**Date:** 8 February 2024



**Federal Aviation  
Administration**



## FAARFIELD 2.1

### Flexible Pavement Design Example

8 February 2024

FAARFIELD 2.1 Design Examples



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# Flexible Pavement Design Example

A flexible 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.

Table 1. Aircraft traffic mix for flexible 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

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

Boring No.	UCSC Soil Type	Moisture Content, %	Optimal MC, %	Dry unit weight, kN/m <sup>3</sup>	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:						



# Flexible 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. **Should the pavement be designed for aircraft arrival or departure weights? What is the required flexible pavement thickness for the runway? What is the most demanding aircraft?**
4. **Perform a sensitivity analysis on the following variables:**
  - Average annual departures of most demanding aircraft (+/- 10 percent of departures).
  - Departure weight of the most demanding aircraft (+/- 10 percent of weight).
  - Subgrade modulus (+/- 10 percent of modulus).





# Flexible 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. Should the pavement be designed for aircraft arrival or departure weights? What is the required flexible pavement thickness for the runway? What is the most demanding aircraft?

Boring No.	UCSC Soil Type	Moisture Content, %	Optimal MC, %	Dry unit weight, kN/m <sup>3</sup>	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:		15.4	12.4	19.66	2.3	6.7
Std. Deviation:		1.7	1.7	0.68	0.6	2.0



# Starting Screen – No Job Files Created

The screenshot displays the FAARFIELD 2.1.1 (Build 12/21/2023) software interface. The main window is titled "Structure" and contains the following elements:

- Job Information:** Job Name: New Job 1, Thickness Design (dropdown), Run button.
- Structure Name:** New Structure 1, Include in Summary Report (checked), Add To Batch button.
- Pavement Layers:** Pavement Type: (dropdown), Material, Thickness (mm), E (MPa) columns, Select As The Design Layer, Delete Selected Layer buttons.
- Design Life:** 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 (mm): 0.
- Traffic:** Stored Aircraft Mix (dropdown), Save Aircraft Mix to File, Clear All Aircraft from List, Remove Selected Aircraft from Structure, Delete Aircraft Mix File buttons.
- Aircraft Data Table:**

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )

The interface also includes a left sidebar with a tree view showing "New Job 1" and "New Structure 1" under "Structures". A "Notes" panel is visible on the right side.



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# Creating/Naming a Job File

Click “New Job”

Enter Job Name

Enter Section Name

The screenshot displays the FAARFIELD 2.1.1 (Build 12/21/2023) software interface. The 'Explorer' panel on the left shows a tree view with 'New Job 1' selected, and 'New Structure 1' under the 'Structures' folder. The main 'Structure' panel contains the following fields and options:

- Job Name:** New Job 1
- Structure Name:** New Structure 1
- Thickness Design:** (Dropdown menu)
- Run:** (Button)
- Status:** (Button)
- Gear:** (Button)
- Structure:** (Button)
- Include in Summary Report:** (Checked checkbox)
- Add To Batch:** (Checkbox)
- Pavement Layers:** (Section header)
- Pavement Type:** (Dropdown menu)
- Material:** (Table header)
- Thickness (mm):** (Table header)
- E (MPa):** (Table header)
- Select As The Design Layer:** (Button)
- Delete Selected Layer:** (Button)
- Design Life (Years):** 20
- The standard design life for pavement structure is 20 years (1 to 50 allowed).**
- Results:**
- Calculated Life (Years):** (Empty field)
- Total thickness to the top of the subgrade (mm):** 0
- Copy Structure to Clipboard:** (Button)

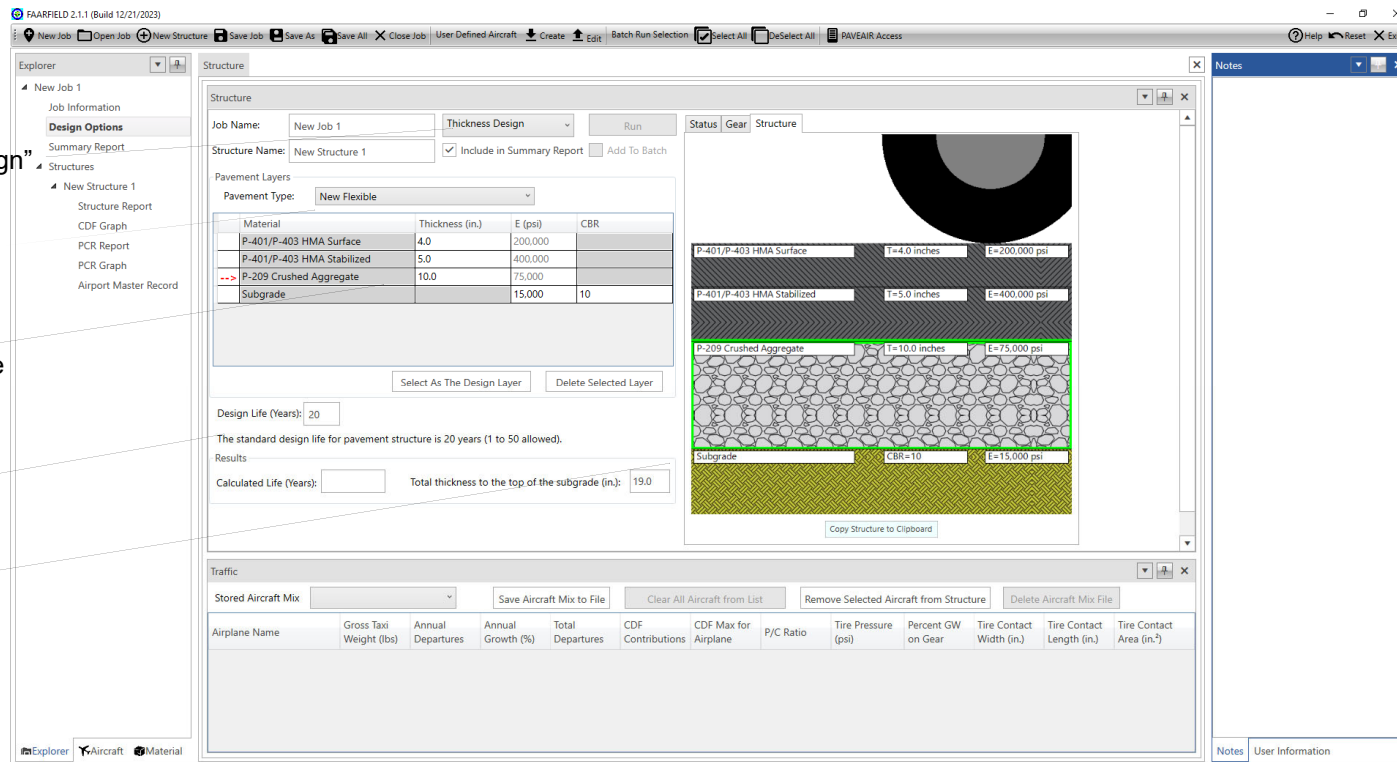
The 'Traffic' panel at the bottom shows a table for 'Stored Aircraft Mix' with the following columns:

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)



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# Selecting Structure



# Design Options

Click "Design Options"

Select Option for "HMA CDF"

"Automatic Flexible Base Design"

"Output File"

"Units"

Set Units to "Metric"

FAARFIELD 2.1.1 (Build 12/21/2023)

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

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	254	517.11	
Subgrade		103.42	10

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 (mm): 483

Traffic

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )

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

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Bril\Documents\My FAARFIELD\User Defined Aircraft

Change Aircraft Directory



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# Materials Library – Layer Types

Click "Materials" tab to open materials library

The screenshot displays the FAARFIELD 2.1.1 software interface. The 'Material' tab is selected in the left-hand navigation pane, showing a list of materials under 'Aggregate' and 'Stabilized' categories. The main window shows the 'Structure' tab with a 'Pavement Layers' table and a 'Design Options' panel on the right.

**Pavement Layers Table:**

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	254	517.11	
Subgrade		103.42	10

**Design Options Panel:**

- 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: No
- Reset Default to Initial: No
- Show/Hide Pavement Image: No
- Change Pavement Graphics: No
- User Defined Aircraft Directory: C:\Users\David Bril\Documents\My FAARFIELD\User Defined Aircraft
- Change Aircraft Directory: No

**Traffic Table:**

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)
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# Aircraft Library

Click "Aircraft" tab to open aircraft library

The screenshot displays the FAARFIELD 2.1.1 (Build 12/21/2023) software interface. The left sidebar shows the 'Aircraft' tab selected, revealing the 'FAARFIELD Aircraft Library' with a list of aircraft models including 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, and S-60. The main window is divided into several panels:

- Structure Summary Report:** Contains fields for Job Name (New Job 1), Structure Name (New Structure 1), and Pavement Type (New Flexible). It includes a table of pavement layers and a 'Run' button.
- Structure Design:** A cross-sectional diagram of a pavement structure with layers labeled: P-401/P-403 HMA Surface (T=102 mm, E=1,378.95 MPa), P-401/P-403 HMA Stabilized (T=127 mm, E=2,757.90 MPa), P-209 Crushed Aggregate (T=254 mm, E=517.11 MPa), and Subgrade (CBR=10, E=103.42 MPa).
- Traffic:** A table for 'Stored Aircraft Mix' with columns for Airplane Name, Gross Taxi Weight (kg), Annual Departures, Annual Growth (%), Total Departures, CDF Contributions, CDF Max for Airplane, P/C Ratio, Tire Pressure (kPa), Percent GW on Gear, Tire Contact Width (mm), Tire Contact Length (mm), and Tire Contact Area (mm²).
- Design Options:** A panel on the right with various settings such as 'Calculate 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'.



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## Aircraft Library – Completely reorganized and updated for the FAARFIELD 2.0 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 C55	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 C525	KC-10
S-45	A320-200 WV000 Bogie	B737-900 ER					P-3C



# Creating Aircraft Traffic Mix

**FAARFIELD 2.1.1 (Build 12/21/2023)**

**Aircraft**

- FAARFIELD Aircraft Group
  - Generic
  - Airbus
  - Boeing**
  - McDonnell Douglas
  - Other Large Jet
  - Regional/Commuter
  - General Aviation
  - Military
  - Non-Airplane Vehicles
  - External Library

**Structure Summary Report**

Job Name: New Job 1 Thickness Design Run

Structure Name: New Structure 1 ☒ Include in Summary Report ☐ Add To Batch

Pavement Layers

Pavement Type: New Flexible

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	254	517.11	
Subgrade		103.42	10

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 (mm): 483

**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 (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-9	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WN000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WN000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
<b>B777-300</b>	<b>263,083</b>	<b>1,500</b>	<b>0</b>	<b>30,000</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1298.75</b>	<b>0.95</b>	<b>354</b>	<b>566</b>	<b>157,264</b>

**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 FCC: 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\David Bril\Documents\My FAARFIELD\User Defined Aircraft

Change Aircraft Directory

Design Options Notes User Information

- Select aircraft from the library by aircraft group and type.
- Double-click the aircraft name, or drag/drop into the traffic table.
- Once done, click "Save Aircraft Mix to File." Give it a file name.
- Traffic files are stored in *My FAARFIELD/TrafficLibrary*

Highlight an aircraft to display gear geometry. (Gear geometry displays in window.)



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# Subgrade CBR

The screenshot displays the FAARFIELD 2.1.1 software interface. The main window shows the 'Structure Summary Report' for 'New Job 1'. The 'Pavement Layers' table lists the following layers:

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	254	517.11	
Subgrade		48.61	4.7

The 'Materials Menu' dialog box is open, showing the 'Subgrade' material type. The 'Aggregate' section is selected, and the 'P-209 Crushed Aggregate' is chosen. The 'Update Thickness (in.)' is set to 12.0, 'Update Modulus (psi)' is 15,000, 'Update Concrete Flexural Strength R (psi)' is blank, 'Update CBR' is 4.7, and 'Update Subgrade Reaction (pci)' is 172.4.

The 'Traffic' window shows a table of aircraft data:

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

- Enter Subgrade CBR
- Modulus is computed as  $1500 \times \text{CBR (psi)}$
- Enter data directly in the table, or click on a layer to bring up the layer property dialog box.



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# Performing Pavement Thickness Design

Click "Run" to start pavement thickness design

**Structure Summary Report**

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 Flexible

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	254	517.11	
Subgrade		48.61	4.7

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 (mm): 483

Copy Structure to Clipboard

**Traffic**

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

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

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 FCC: 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\David Bril\Documents\My FAARFIELD\User Defined Aircraft

Change Aircraft Directory

Design Options Notes User Information



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# Completed Pavement Thickness Design

P-209 Thickness was designed

P/C Ratio for each aircraft

CDF max. for aircraft

CDF contribution of each aircraft

**Structure Summary Report**

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 Flexible

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	
Subgrade		48.61	4.7

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 (mm): 909

Traffic

Stored Aircraft Mix: BKK Example | Save Aircraft Mix to File | Clear All Aircraft from List | Remove Selected Aircraft from Structure | Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	1.77	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	1.33	1043.63	0.95	281	450	99,204
B737-9	62,822	5,000	0	100,000	0	0	1.26	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0.01	0.01	1.13	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0.35	0.39	1.15	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0.02	0.76	1.25	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0.62	0.62	1.19	1298.75	0.95	354	566	157,264

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:

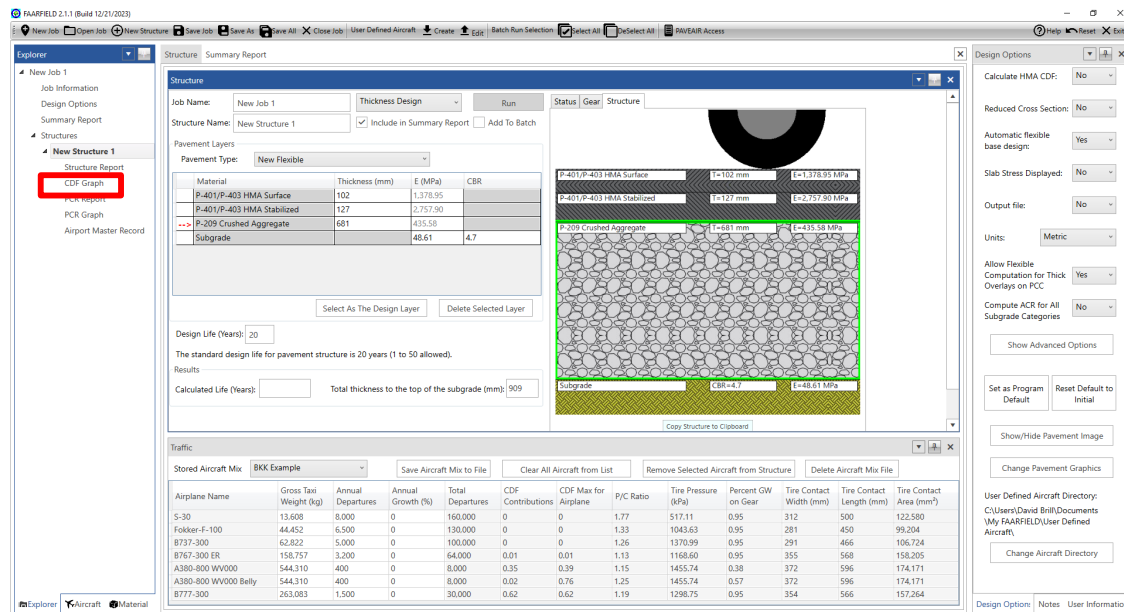
Show/Hide Pavement Image:

Change Pavement Graphics:

User Defined Aircraft Directory: C:\Users\David Bril\Documents\My FAARFIELD\User Defined Aircraft\ Change Aircraft Directory:

Design Options | Notes | User Information

# CDF Chart



Job Name: New Job 1

Structure: New Structure 1

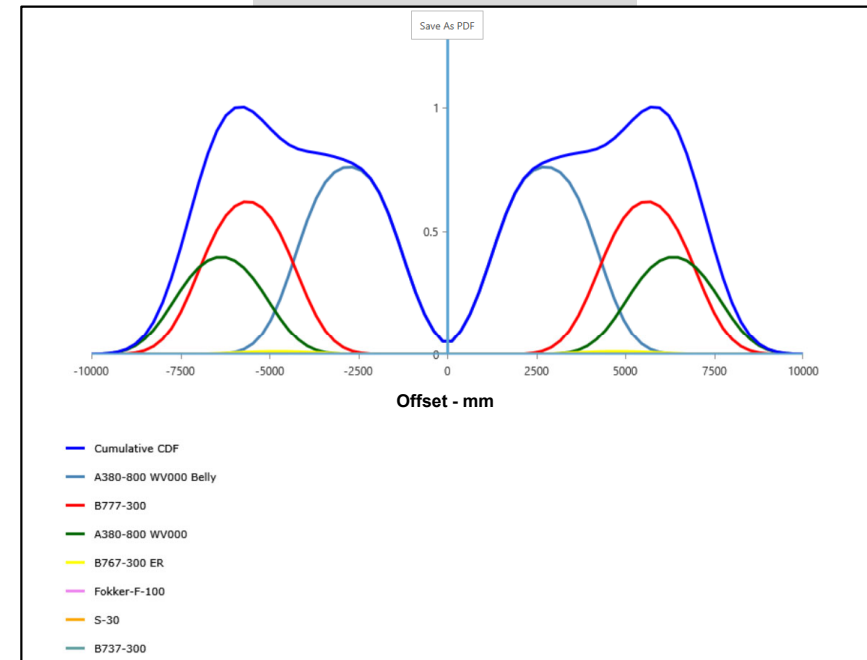
Analysis Type: New Flexible

Analysis Run Time: 2024-01-30 09:15:41

Last Run: Thickness Design

Design Life = 20.0 Years

Total thickness to the top of the subgrade = 909mm



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# Structure Report

**FAARFIELD 2.1.1 (Build 12/21/2023)**

Menu: 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**
      - PCR Report
      - PCR Graph
      - Airport Master Record

Structure Summary Report

Save As PDF

### Federal Aviation Administration FAARFIELD 2.1 Structure Report

FAARFIELD 2.1.1 (Build 12/21/2023)

**Job Name:** New Job 1

**Structure:** New Structure 1

**Analysis Type:** New Flexible

**Last Run:** Thickness Design 2024-01-30 09:15:41

**Design Life =** 20 Years

**Total thickness to the top of the subgrade =** 909mm

#### Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	CBR	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	102	1,378.95	0	0.35	0
2	P-401/P-403 HMA Stabilized	127	2,757.90	0	0.35	0
3	P-209 Crushed Aggregate	681	435.58	0	0.35	0
4	Subgrade	0	48.61	4.7	0.35	0

#### Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	S-30	13,608	8,000	0
2	Fokker-F-100	44,452	6,500	0
3	B737-300	62,822	5,000	0
4	B767-300 ER	158,757	3,200	0

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

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Brill\Documents\My FAARFIELD\User Defined Aircraft\

Change Aircraft Directory

Design Options | Notes | User Information

# Life/Compaction

The screenshot displays the FAARFIELD 2.1.1 software interface. The main window is titled 'Structure' and shows the 'Life/Compaction' design process. The 'Job Name' is 'New Job 1' and the 'Structure Name' is 'New Structure 1'. The 'Pavement Type' is 'New Flexible'. The 'Design Life (Years)' is set to 20. The 'Calculated Life (Years)' is 909, and the 'Total thickness to the top of the subgrade (mm)' is 909. The 'Structure' table lists the following layers:

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	4.7
Subgrade		48.61	4.7

The 'Traffic' table lists the following aircraft:

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171

The 'Design Options' panel on the right shows the following settings:

- 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: [Button]
- Set as Program Default: [Button]
- Reset Default to Initial: [Button]
- Show/Hide Pavement Image: [Button]
- Change Pavement Graphics: [Button]
- User Defined Aircraft Directory: C:\Users\David Brili\Documents\My FAARFIELD\User Defined Aircraft\ [Button]
- Change Aircraft Directory: [Button]

The 'Traffic' panel at the bottom shows the 'Stored Aircraft Mix' and a table of aircraft data.

Select "Life/Compaction"

Click "Run" to start Life and Compaction requirements



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# Life/Compaction

The screenshot displays the FAARFIELD 2.1.1 software interface. The main window shows the 'Structure' tab with the following details:

- Job Name:** New Job 1
- Structure Name:** New Structure 1
- Pavement Type:** New Flexible
- Pavement Layers:**

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	
Subgrade		48.61	4.7
- Design Life (Years):** 20
- Calculated Life (Years):** 20.0
- Total thickness to the top of the subgrade (mm):** 909

A red box highlights the 'Status' tab, which displays the following results:

**Status** | Gear | Structure

New Flexible Analysis of New Structure 1 Completed  
 Run Time: 4 seconds  
 Sub CDF = 1.00; Life = 20.0 yrs;  
 HMA CDF = 0.03

The bottom section of the interface shows the 'Traffic' tab with a table of aircraft data:

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	1.77	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	1.33	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	1.26	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0.01	0.01	1.13	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0.35	0.39	1.15	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0.02	0.76	1.25	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0.62	0.62	1.19	1298.75	0.95	354	566	157,264

Pavement Life results

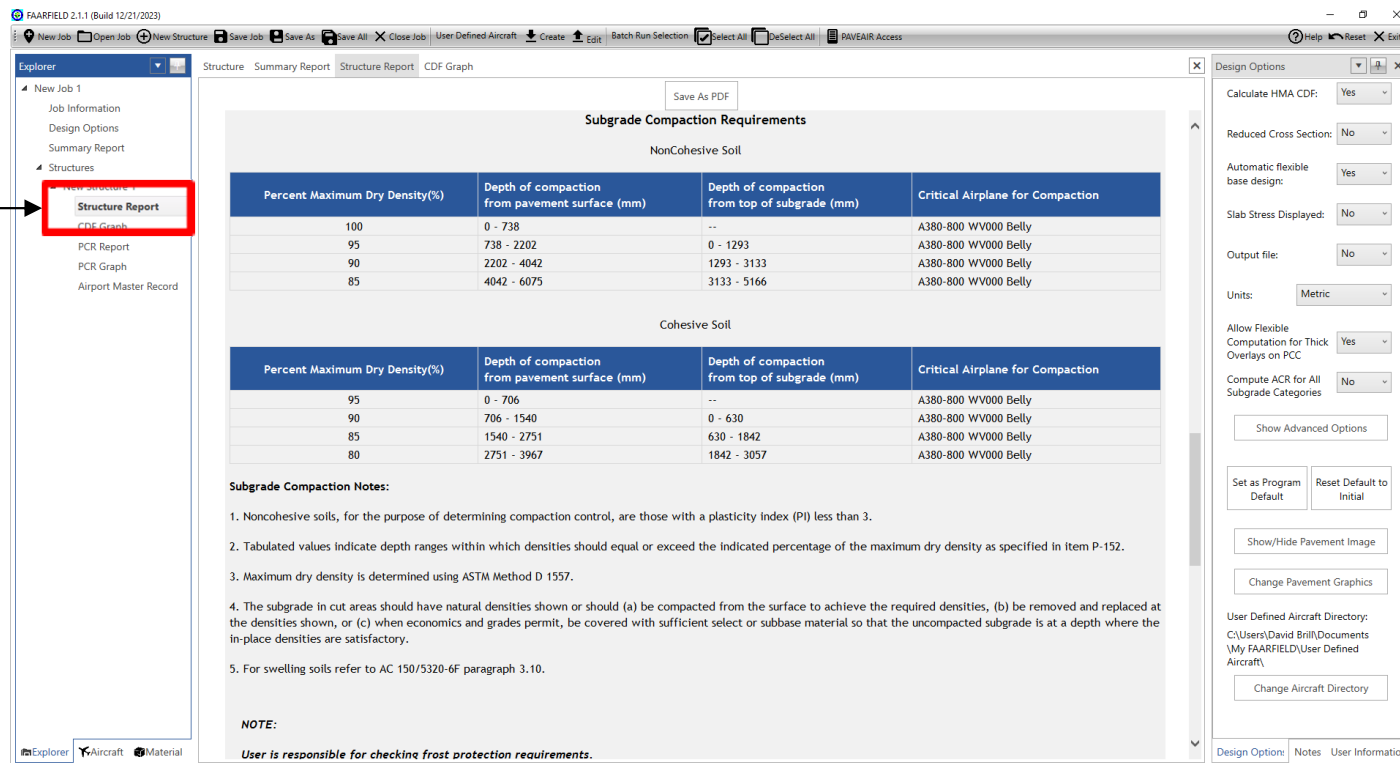


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# Compaction Requirements

Section Report



FAARFIELD 2.1.1 (Build 12/21/2023)

Menu: 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: New Job 1, Job Information, Design Options, Summary Report, Structures, New Structure, Structure Report (highlighted), CDF Graph, PCR Report, PCR Graph, Airport Master Record

Structure Summary Report Structure Report CDF Graph

Save As PDF

### Subgrade Compaction Requirements

NonCohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (mm)	Depth of compaction from top of subgrade (mm)	Critical Airplane for Compaction
100	0 - 738	--	A380-800 WV000 Belly
95	738 - 2202	0 - 1293	A380-800 WV000 Belly
90	2202 - 4042	1293 - 3133	A380-800 WV000 Belly
85	4042 - 6075	3133 - 5166	A380-800 WV000 Belly

Cohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (mm)	Depth of compaction from top of subgrade (mm)	Critical Airplane for Compaction
95	0 - 706	--	A380-800 WV000 Belly
90	706 - 1540	0 - 630	A380-800 WV000 Belly
85	1540 - 2751	630 - 1842	A380-800 WV000 Belly
80	2751 - 3967	1842 - 3057	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:**  
User is responsible for checking frost protection requirements.

Design Options: Calculate HMA CDF: Yes, 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, Change Pavement Graphics, User Defined Aircraft Directory: C:\Users\David Brili\Documents\My FAARFIELD\User Defined Aircraft, Change Aircraft Directory

Design Options Notes User Information



# PCR

Select “PCR” in the function drop-down box.

Click “Run” to execute PCR Computations

FAARFIELD 2.1.1 (Build 12/21/2023)

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

Structure: Summary Report, Structure Report, CDF Graph

Job Name: New Job 1, Function: PCR, Run

Structure Name: New Structure 1, Include in Summary Report: ☒, Add To Batch: ☐

Pavement Layers: New Flexible

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	
Subgrade		48.61	4.7

Select As The Design Layer, Delete Selected Layer

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

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

Results: Calculated Life (Years): 20.0, Total thickness to the top of the subgrade (mm): 909

Traffic: Stored Aircraft Mix: BKK Example, Save Aircraft Mix to File, Clear All Aircraft from List, Remove Selected Aircraft from Structure, Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)	ACR Thi (D)
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580	0
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204	0
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724	0
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205	0
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171	0
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171	0

Design Options: Notes, User Information

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 FCC: 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\David Brili\Documents\My FAARFIELD\User Defined Aircraft, Change Aircraft Directory



# PCR

## Results of PCR computations

The screenshot displays the FAARFIELD 2.1.1 software interface. The main window shows the 'Structure' tab with the following details:

- Job Name:** New Job 1
- Structure Name:** New Structure 1
- Pavement Type:** New Flexible
- Material Layers:**

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	
Subgrade		48.61	4.7
- Design Life (Years):** 20
- P/TC Ratio:** 1
- Results:**
  - Calculated Life (Years):
  - Total thickness to the top of the subgrade (mm): 909

The 'Status' window shows the completion of the PCR calculation:

- PCR Calculation of New Structure 1 Completed
- Run Time: 12 seconds
- PCR = 850/F/D/X/T

The 'Traffic' window displays a table of stored aircraft mix data:

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)	ACR Thi (D)
S-30	13,608	8,000	0	160,000	0	0	3.7	517.11	0.95	312	500	122,580	427
Fokker-F-100	44,452	6,500	0	130,000	0	0	2.07	1043.63	0.956	281	450	99,204	643
B737-300	62,822	5,000	0	100,000	0	0	2.18	1370.99	0.908	291	466	106,724	699
B767-300 ER	158,757	3,200	0	64,000	0	0	1.13	1168.60	0.924	355	568	158,205	805
A380-800 WV000	544,310	400	0	8,000	0.36	0.4	1.19	1455.74	0.38	372	596	174,171	960
A380-800 WV000 Belly	544,310	400	0	8,000	0.02	0.76	0.88	1455.74	0.57	372	596	174,171	0



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# PCR Report

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

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

Structure Summary Report Structure Report CDF Graph PCR Report

Save As PDF

Maximum number of wheels per gear = 6

CDF = 0.980

At least one aircraft has 4 or more wheels per gear.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight (kg)	Percent Gross Weight	Tire Pressure (MPa)	Annual Departure	20 Years Coverage
1	S-30	13,608	95.00	517.11	8,000	43,206
2	Fokker-F-100	44,452	95.60	1,043.63	6,500	62,737
3	B737-300	62,822	90.80	1,370.99	5,000	45,957
4	B767-300 ER	158,757	92.40	1,168.60	3,200	56,882
5	A380-800 WV000	544,310	38.00	1,455.74	400	6,721
6	A380-800 WV000 Belly	544,310	57.00	1,455.74	400	9,115
7	B777-300	263,083	94.80	1,298.75	1,500	35,719

Results Table 2. PCR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft (kg)	ACR Thick at max. MGW (mm)	PCR/F/D
1	A380-800 WV000	518	544,954	961	847.8

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

No.	Aircraft Name	Gross Weight (kg)	Percent Gross Weight on Main Gear	Tire Pressure (MPa)	ACR Thick (mm) (D)	ACR/F/D
1	S-30	13,608	95	517.11	427	113.9
2	Fokker-F-100	44,452	95.6	1,043.63	643	314.6
3	B737-300	62,822	90.8	1,370.99	699	382.9
4	B767-300 ER	158,757	92.4	1,168.60	805	543.8
5	A380-800 WV000	544,310	95	1,455.74	960	845.7
6	B777-300	263,083	94.8	1,298.75	902	727.2

Explorer Aircraft Material



# PCR Graph



- Black horizontal line represents PCR.
- Blue vertical bars represent ACR of individual aircraft.
- PCR is just sufficient to allow unrestricted operations, consistent with thickness design.



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# Airport Master Record

FAARFIELD 2.1.1 (Build 12/21/2023)

Structure Summary Report Structure Report CDF Graph PCR Report PCR Graph Airport Master Record

Save As PDF

**Federal Aviation Administration FAARFIELD 2.1 Airport Master Record**

FAARFIELD 2.1.1 (Build 12/21/2023)

**RUNWAY DATA**

Job Name: New Job 1

Structure: New Structure 1

**Gross Weight (In THSDS)**

35 S	120
36 D	250
37 2D	352
38 2D/2D2	864
39 PCR	850/F/D/X/T

base design: New

Slab Stress Displayed: No

Output file: No

Units: Metric

Allow Flexible Computation for Thick Overlays on FCC: Yes

Compute ACR for All Subgrade Categories: No

Show Advanced Options

Set as Program Default: Set as Program Default

Reset Default to Initial: Reset Default to Initial

Show/Hide Pavement Image

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Brill\Documents\My FAARFIELD\User Defined Aircraft

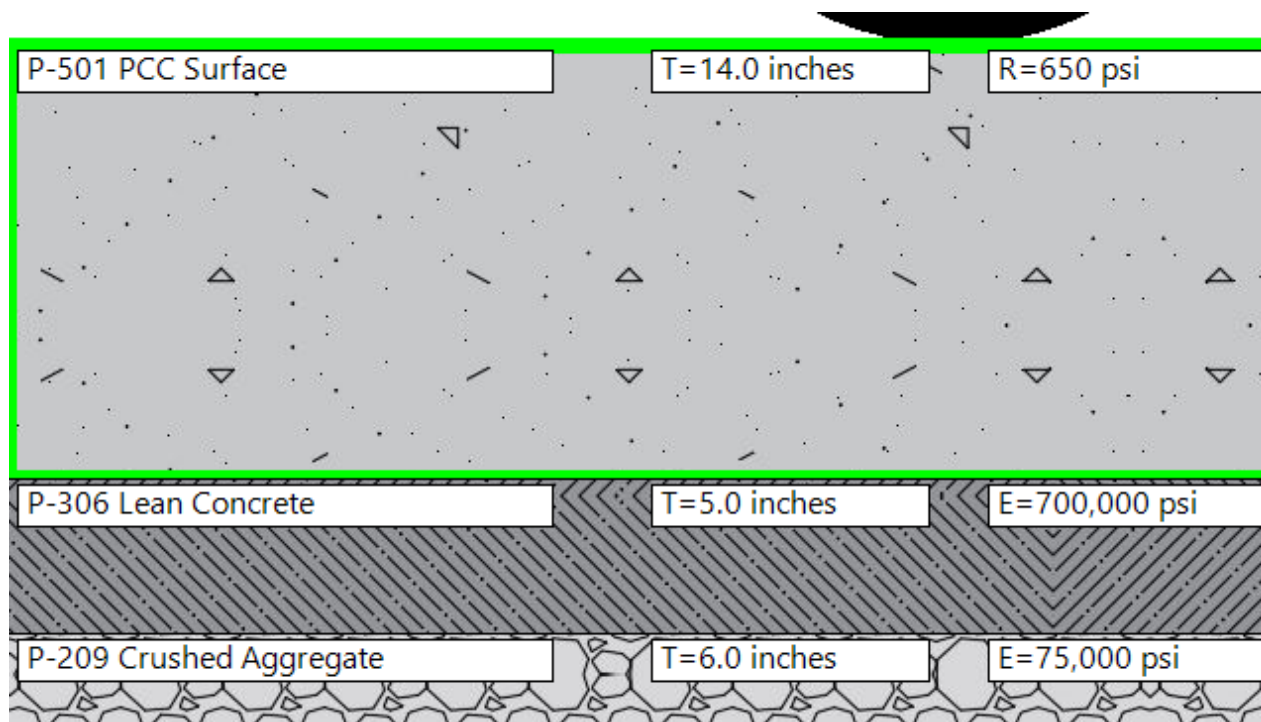
Change Aircraft Directory

Design Options Notes User Information

U.S. airports use this information to populate the Airport Master Record (AMR)

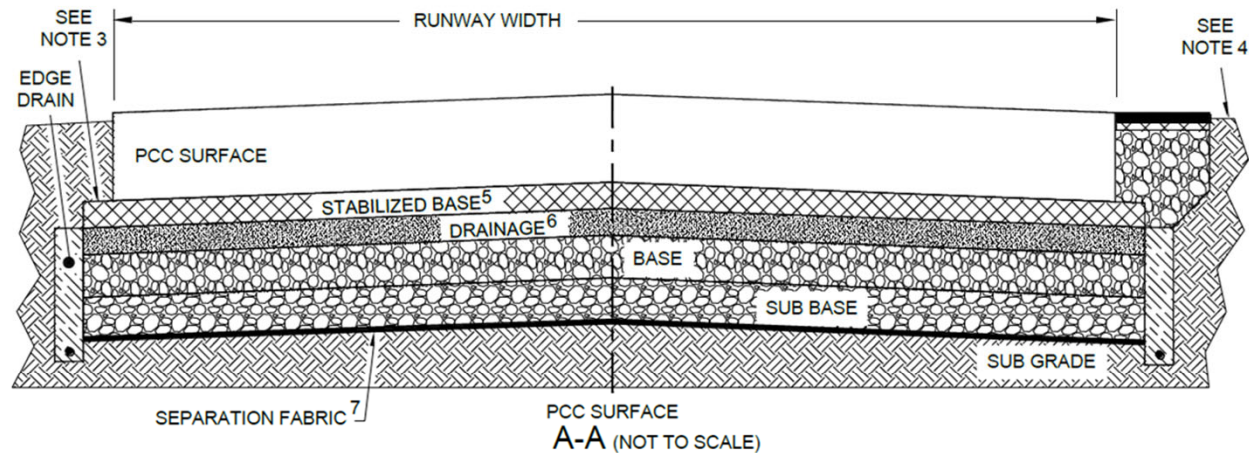


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## Rigid Pavement Design Example Using FAARFIELD 2.1

# 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.



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# 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:**

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

**where:**

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

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

$R$  = concrete flexural strength (ASTM C78)

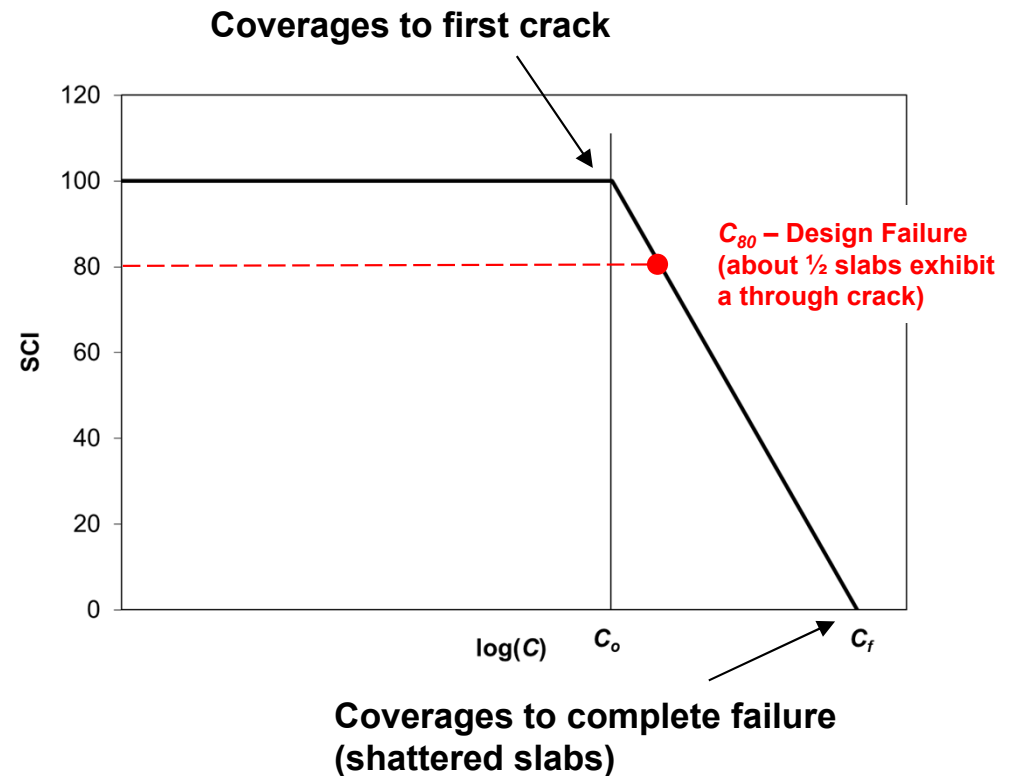
$\sigma$  = max. computed tensile stress

$C$  = 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

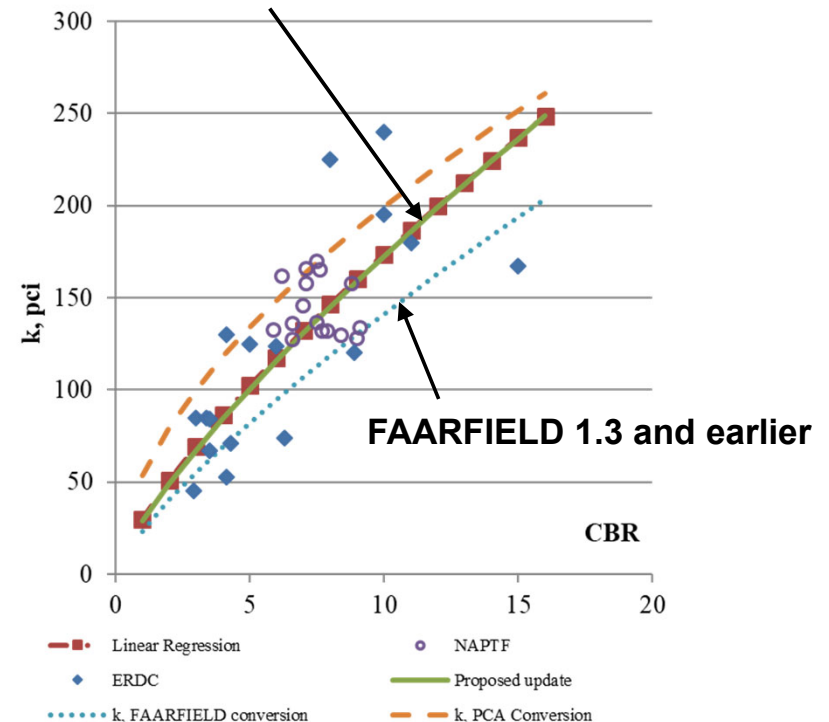
- FAARFIELD automatically converts  $k$  to  $E$ , and vice-versa.
- The conversion formula implemented in FAARFIELD 2.0 is:

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

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 2.0 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 4.6 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 flexible example!**

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

Boring No.	UCSC Soil Type	Moisture Content, %	Optimal MC, %	Dry unit weight, kN/m <sup>3</sup>	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 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  $E_{SG} \sim 47 \text{ MPa (10 CBR)}$

1. What type and thickness of base/subbase materials do you recommend? Are positive drainage features required?
2. 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 = 4.6 MPa, the allowable design strength is  $1.05 \times 4.6 = 4.83 \text{ MPa}$ .  
Use 4.8 MPa in the FAARFIELD design.
1. Should the pavement be designed for aircraft arrival or departure weights? What is the required flexible pavement thickness for the runway? What is the most demanding aircraft?

Boring No.	UCSC Soil Type	Moisture Content, %	Optimal MC, %	Dry unit weight, kN/m <sup>3</sup>	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:		15.4	12.4	19.66	2.3	6.7
Std. Deviation:		1.7	1.7	0.68	0.6	2.0



# Creating/Naming a Structure

Click on “New Structure”

Enter Structure Name”

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

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

Structure

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

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

Pavement Layers

Pavement Type:

Material	Thickness (mm)	E (MPa)
To begin select a Pavement Type		

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 (mm): 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 (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )

Design Options

Calculate HMA CDF: Yes

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 FCC: 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\David Bril\Documents\My FAARFIELD\User Defined Aircraft

Change Aircraft Directory

Design Options Notes User Information

# Select Pavement Type

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 2.1.1 (Build 12/21/2023)

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

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

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	356	27,579.04		4.48
P-401/P-403 HMA Stabilized	127	2,757.90		
P-209 Crushed Aggregate	152	517.11		
Subgrade		101.42	46.8	

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 (mm): 635

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 (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
---------------	------------------------	-------------------	-------------------	------------------	-------------------	----------------------	-----------	---------------------	--------------------	-------------------------	--------------------------	--------------------------------------

Design Options: ☐ Calculate HMA CDF: Yes | ☐ 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 | Change Pavement Graphics | User Defined Aircraft Directory: C:\Users\David Brili\Documents\My FAARFIELD\User Defined Aircraft | Change Aircraft Directory | Design Options | Notes | User Information



Federal Aviation  
Administration



# Creating Aircraft Traffic Mix

Several ways to add 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.

Select an aircraft to display gear geometry.

**Structure Panel:**

Job Name: New Job 1  
Structure Name: Rigid Example  
Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	356	27,579.04		4.48
P-401/P-403 HMA Stabilized	127	2,757.90		
P-209 Crushed Aggregate	152	517.11		
Subgrade		103.42	46.8	

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 (mm): 635

**Traffic Panel:**

Stored Aircraft Mix: BKK Example

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WNW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WNW000 Betty	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264



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# Modify Default Layer Properties

**Structure**

Job Name: New Job 1 Thickness Design

Structure Name: Rigid Example ☒ Include in Summary Report

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m³)
P-501 PCC Surface	356	27,579.04	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	152	517.11	
Subgrade		47.00	25.3

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 (mm):

**Traffic**

Stored Aircraft Mix: BKK Example

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WJ000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WJ000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

- Enter the modulus value based on design CBR (47 MPa).
- FAARFIELD computes an equivalent k-value using the conversion formula.



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Administration

# Modify Default Layer Properties

**Structure**

Job Name: New Job 1 Thickness Design Run

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

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	356	27,579.04		4.48
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	517.11		
Subgrade		47.00	25.3	

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 (mm): 683

**Traffic**

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WNV000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WNV000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

Design Options: Notes User Information

Select Base & Subbase type and thickness



Federal Aviation  
Administration

# 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 Example Include in Summary Report Add To Batch

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	356	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	517.11		
Subgrade		47.00	25.3	

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 (mm): 683

Traffic

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WNV000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WNV000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

Design Options: Notes User Information



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# Run Pavement Thickness Design

**Structure**

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

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

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	356	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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 (mm): 683

Running Time : 00:01:05

New Rigid of Rigid Example started.

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

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Brili\Documents\My FAARFIELD\User Defined Aircraft

Change Aircraft Directory

Design Options Notes User Information

**Traffic**

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

- 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!

# Completed Pavement Thickness Design

**Structure**

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

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

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	410	27,779.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	16,117		
Subgrade		47.00	25.3	

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 (mm): 737

**Traffic**

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	3.7	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	2.07	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	2.18	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	1.13	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0.11	1.19	1.19	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0.98	0.99	0.88	1455.74	0.57	372	596	174,171

**Results**

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

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Bril\Documents\My FAARFIELD\User Defined Aircraft 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

- Design thickness is 410 mm
- Round to the nearest 0.5 in or 1 cm.
- Specify as 41 cm.



Federal Aviation Administration

# CDF Chart

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

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
    - Rigid Example
      - Structure Report
      - CDF Graph**
      - PCR Report
      - PCR Graph
      - Airport Master Record

Structure CDF Graph

Structure

Job Name: New Job 1 Thickness Design

Structure Name: Rigid Example ☒ Include in Summary Report

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k
P-501 PCC Surface	410	27,579.04	
P-306 Lean Concrete	127	4,826.33	
P-209 Crushed Aggregate	200	167.17	
Subgrade		47.00	25

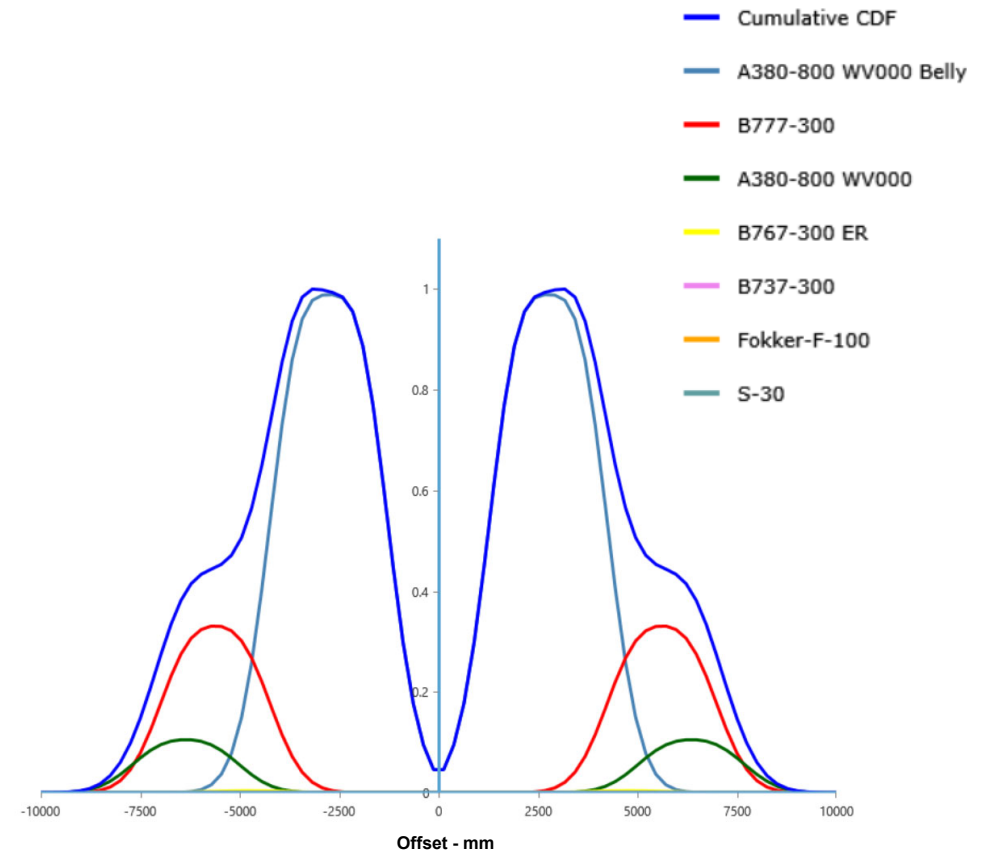
Select As The Design Layer Delete

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 subgr





# 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       $E_{SG} = 47 \text{ MPa}$

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 = 4.6 MPa, the allowable design strength =  $1.05 \times 4.6 = 4.83 \text{ MPa}$ .

Use  $R = 4.8 \text{ MPa}$  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 2.0 gives a slab thickness 41 cm.

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 2.1.1 software interface. On the left, the 'Explorer' pane shows a tree view with 'New Job 1' expanded, and 'Structure Report' selected under 'Rigid Example'. A red arrow points to this selection. The main window shows the 'Structure Report' for 'New Job 1', which is a 'Rigid Example'. The report includes the following information:

- Job Name:** New Job 1
- Structure:** Rigid Example
- Analysis Type:** New Rigid
- Last Run:** Thickness Design 2024-01-30 10:46:59
- Design Life:** 20 Years
- Total thickness to the top of the subgrade:** 737mm

The report also includes two tables:

**Pavement Structure Information by Layer**

No.	Type	Thickness (mm)	Modulus (MPa)	k (MN/m <sup>3</sup> )	Poisson's Ratio	Strength R (MPa)
1	P-501 PCC Surface	410	27,579.04	0	0.15	4.80
2	P-306 Lean Concrete	127	4,826.33	0	0.2	0
3	P-209 Crushed Aggregate	200	167.17	0	0.35	0
4	Subgrade	0	47.00	25.3	0.4	0

**Airplane Information**

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	S-30	13,608	8,000	0
2	Fokker-F-100	44,452	6,500	0
3	B737-300	62,822	5,000	0
4	B767-300 ER	158,757	3,200	0

The right side of the interface shows the 'Design Options' pane with various settings for the analysis, including 'Calculate 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', and 'Show Advanced Options'.



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# Life/Compaction

FAARFIELD 2.1.1 (Build 12/21/2023)

Menu: New Job, Open Job, New Structure, Save Job, Save As, 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, Rigid Example, Structure Report, CDF Graph, PCR Report, PCR Graph, Airport Master Record

Structure: Structure Report CDF Graph

Structure: Job Name: New Job 1, Life/Compaction, Run, Status, Gear, Structure

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

Pavement Layers: Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	410	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

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 (mm): 737

Traffic: Stored Aircraft Mix: BKK Example, Save Aircraft M

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total
S-30	13,608	8,000	0	160
Fokker-F-100	44,452	6,500	0	130
B737-300	62,822	5,000	0	100
B767-300 ER	158,757	3,200	0	64
A380-800 WV000	544,310	400	0	8,000
A380-800 WV000 Belly	544,310	400	0	8,000

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, Reset Default to

Design Options: Notes User Information

Callout 1: Select "Life/Compaction"

Callout 2: 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.



Federal Aviation  
Administration

# Life/Compaction

FAARFIELD 2.0.18a (Build 05/19/2022)

Job Name: BKK Workshop Life/Compaction Run

Section Name: Rigid Example ☒ Include in Summary Report ☐ Add To Batch

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-501 PCC Surface	410	27,579.04		
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.14		
Subgrade		46.99		

Select As The Design Layer

Design Life (Years): 20

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

Results

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

Traffic

Stored Aircraft Mix: BKK Example Save Aircraft Mix

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	Contributions	Airplane	P/C Ratio	(kPa)	on Gear	Width (mm)	Length (mm)	Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	6.33	517.11	0.95	312	500	122,500
Fokker-F-100	44,452	6,500	0	130,000	0	0	3.72	1043.63	0.95	281	450	99,206
B737-300	62,822	5,000	0	100,000	0	0	3.8	1370.99	0.95	291	466	106,722
B767-300 ER	158,757	3,200	0	64,000	0	0	3.63	1168.60	0.95	353	565	156,451
A380-800 WV000	544,310	400	0	8,000	0	0.11	3.83	1455.74	0.38	372	596	174,174
A380-800 WV000 Belly	544,310	400	0	8,000	0.98	0.99	4.25	1455.74	0.57	372	596	174,174

## Pavement Life Results

Status Gear Structure

New Rigid Analysis Completed  
Run Time: 118 seconds  
%CDFU = 197.28; PCC CDF = 1.00; Life = 20.0 yrs;

Design Options

Calculate HMA CDF: No

Automatic flexible base design: Yes

Output file: No

Units: Metric

Allow Flexible Computation for Thick: Yes



Federal Aviation  
Administration

# Compaction Requirements

FAARFIELD 2.1.1 (Build 12/21/2023)

Save As PDF

### Subgrade Compaction Requirements

NonCohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (mm)	Depth of compaction from top of subgrade (mm)	Critical Airplane for Compaction
100	0 - 15	--	A380-800 WV000 Belly
95	15 - 21	--	A380-800 WV000 Belly
90	21 - 122	0 - 93	A380-800 WV000 Belly
85	122 - 214	93 - 185	A380-800 WV000 Belly

Cohesive Soil

Percent Maximum Dry Density(%)	Depth of compaction from pavement surface (mm)	Depth of compaction from top of subgrade (mm)	Critical Airplane for Compaction
95	0 - 14	--	A380-800 WV000 Belly
90	14 - 18	--	A380-800 WV000 Belly
85	18 - 53	0 - 24	A380-800 WV000 Belly
80	53 - 118	24 - 89	A380-800 WV000 Belly

**Subgrade Compaction Notes:**

1. Noncohesive soils, for the purpose of determining compaction control, are those with a plasticity index (PI) less than 3.
2. 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.
3. Maximum dry density is determined using ASTM Method D 1557.
4. 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.
5. For swelling soils refer to AC 150/5320-6F paragraph 3.10.

**NOTE:**  
User is responsible for checking frost protection requirements.

- 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: 598740 / 489880 kg.**
- Subgrade modulus (+/- 10 percent of modulus).  
 **$E = 42.3 / 51.7$  MPa**
- Concrete Flexural Strength (+/- 10 percent of  $R$ ).  
 **$R = 4.32 / 5.28$  MPa**

*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.*



## Overlay Design Example Using FAARFIELD 2.1

# FAARFIELD Overlay Design

- **HMA Overlays on Flexible Pavement**
  - Same as designing a new flexible pavement, except the design layer is the HMA overlay.
- **PCC Overlays on Flexible Pavement**
  - Same principle as new rigid design.
- **HMA Overlays on Rigid Pavement**
- **PCC Overlays on Rigid Pavement**
  - More complex than new rigid pavement design.
  - Both slabs (base PCC and overlay) deteriorate with applied traffic. Stresses are computed for both slabs.
  - E-modulus of the base slab is a function of reduced SCI.

# FAARFIELD Overlay Design – PCC on Rigid Overlays

- **Fully bonded overlays**
  - Treat as a new rigid pavement design.
  - Thickness of overlay slab is  $h_{overlay} = h_{design} - h_{exist}$ .
- **Unbonded overlay**
  - Bond breaker or leveling course is used.
- **Partially bonded overlay**
  - Not a standard design in AC 150/5320-6F.
  - Default in FAARFIELD is off.
  - May be enabled from the Options window, but displays a “Non Standard Structure” message.





# FAARFIELD Overlay Design – HMA on Rigid Overlays

- **See AC 150/5320-6G, Paragraphs 4.7.5.5 & 4.7.5.6**
- **Current design procedure does not address reflection cracking.**
- **Default model assumes base concrete pavement continues to deteriorate under traffic, reaching a terminal SCI at end of life.**
- **Thick asphalt overlays on existing rigid pavements.**
  - Applies only when the overlay thickness exceeds the concrete thickness.
  - Can treat as a flexible design where the existing concrete acts as a high-quality base material.
  - Program performs both designs - reports the one that gives the thinner overlay.



# FAARFIELD Overlay Design

## Required Inputs

- **Existing rigid pavement condition is characterized by the Structural Condition Index (SCI).**
  - SCI derived from PCI as determined by ASTM D 5340, Airport Pavement Condition Index Surveys. AC 150/5320-6G, par. 4.7.5.3, gives guidance on SCI.
  - SCI is computed using only structural components from the PCI survey.
- **SCI = 80 is the FAA definition of structural failure. This is equivalent to 50% of the slabs in a section exhibiting a full-width structural crack)**
- **For existing pavements with structural damage (SCI < 100)**
  - The user inputs a value of SCI for the existing pavement.
  - The range of allowable values is SCI 67 – 100.
  - The Help file also gives approximate formulas for relating SCI to  $C_r$  and  $C_b$  factors in earlier FAA design methods.



# FAARFIELD – PCC Unbonded Overlay Design Structural Condition Index (SCI)

## Rigid Pavement Distress Types Used to Calculate SCI

Distress	Severity Level
Corner Break	Low, Medium, High
Longitudinal/Transverse/Diagonal Cracking	Low, Medium, High
Shattered Slab	Low, Medium, High
Shrinkage Cracks (cracking partial width of slab)*	Low
Spalling–Joint	Low, Medium, High

\* Used only to describe a load-induced crack that extends only part of the way across a slab. The SCI does not include conventional shrinkage cracks due to curing or other non load-related problems.



# Cumulative Damage Factor Used (CDFU)

**For existing pavements where SCI=100  
(no structural distress):**

- **There is no visible distress contributing to reduction in SCI (no structural distress types). However, some pavement life has been consumed by the applied traffic.**
- **The amount of pavement life consumed before the onset of cracking is the percent CDF Used (%CDFU).**
- **Need to estimate a value of %CDFU.**
- **The Help file gives guidance on estimating %CDFU using the Life key.**

# HMA on Rigid Overlay Example

- **PCC overlay will be placed on an existing PCC slab.**
- **Assume the previous traffic mix.**
- **Existing PCC slab:**
  - 360 mm P-501,  $R = 4.8$  MPa.
  - Assume  $SCI = 80$  for existing slab.
- **All other design inputs same as previous example.**

# Create a New Structure

FAARFIELD 2.1.1 (Build 12/21/2023)

Job Name: BKK Workshop Thickness Design Run Status Gear Structure

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

Pavement Layers

Pavement Type: New Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m³)	R (MPa)
P-501 PCC Surface	410	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20

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 (mm): 737

Copy Structure to Clipboard

Explorer: BKK Workshop  
Job Information  
Design Options  
Summary Report  
Structures  
New Structure 1  
Structure Report  
CDF Graph  
PCR Report  
PCR Graph  
Airport Master Record  
Rigid Example  
Structure Report  
CDF Graph  
PCR Report  
PCR Graph  
Airport Master Record  
HMA Overlay Example  
Structure Report  
CDF Graph  
PCR Report  
PCR Graph  
Airport Master Record

Traffic

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

Aircraft Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)
Boeing 737-300	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,500
Boeing 737-800	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
Boeing 737-900	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
Boeing 737-900 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
Boeing 787-9	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
Boeing 787-9 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
Boeing 777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264



# Modify the Structure

- (1) Click on the P-501 PCC Surface Layer
- (2) On the Materials dialog box, select "P-401/P-403 HMA Overlay."
- (3) Click "Add Layer Above."

The screenshot displays the FAARFIELD 2.1 Design Examples software interface. The main window shows a cross-section of a pavement structure with layers: P-501 PCC Surface, P-306 Lean Concrete, P-209 Crushed Aggregate, and Subgrade. A green box highlights the P-501 PCC Surface layer, with a red circle and the number (1) indicating it is the target for modification. The 'Layer Property' dialog box is open, showing the 'Materials Menu' with options for General, Aggregate, and Stabilized materials. The 'P-401/P-403 HMA Overlay' option is selected under the 'Aggregate' section, with a red circle and the number (2) indicating it is the target for selection. The 'Add Layer Above' button is highlighted with a red circle and the number (3), indicating it is the target for clicking. The 'Update Thickness (mm)' field is set to 410, and the 'Update Modulus (MPa)' field is set to 1,378.95. The 'Update Concrete Flexural Strength R (MPa)' field is empty. The 'Update CBR' field is empty. The 'Update Subgrade Reaction (MN/m^3)' field is empty. The 'Add Layer Below' button is also visible.

**Layer Property**

**Materials Menu**

**General**

- ☐ User Defined
- ☐ Subgrade

**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

**Aggregate**

- ☐ P-154 Uncrushed Aggregate
- ☐ P-208 Crushed Aggregate
- ☐ P-209 Crushed Aggregate
- ☐ P-211 Lime Rock
- ☐ P-219 Recycled Concrete Aggregate

**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)

**Update Thickness (mm)**

410

**Update Modulus (MPa)**

1,378.95

**Update Concrete Flexural Strength R (MPa)**

**Update CBR**

**Update Subgrade Reaction (MN/m^3)**

**Add Layer Below** **Add Layer Above** **OK** **Delete Layer** **Cancel**

**Traffic**

Stored Aircraft Mix: BKK Example

Save Aircraft Mix to File

Clear All Aircraft from List

Remove Selected Aircraft from Structure

Delete Aircraft Mix

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WV000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WV000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

# Modify the Structure

Note – Pavement type has been changed to “HMA Overlay on Rigid.”

Change PCC thickness to 360 mm.

Default SCI = 80 (No Change).

The screenshot displays the FAARFIELD 2.1.1 software interface. The 'Structure' tab is active, showing a cross-section diagram of a pavement structure. The 'Pavement Layers' table is visible, listing the following layers:

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-401/P-403 HMA Overlay	305	1,378.95		
P-501 PCC Surface	360	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade	47.00	25.3		

The 'Design Life (Years)' is set to 20, and the 'Percent CDFU' is 100. The 'Calculated Life (Years)' is 19.92. The 'Total thickness to the top of the subgrade (mm)' is 992.

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

Airplane Name	Weight (kg)	Departures	Growth (%)	Departures	Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264



# Design Options

Design Options – Make sure  
“Allow Flexible Computation for  
Thick Overlays on PCC” is set to  
“Yes.”

The screenshot shows the FAARFIELD 2.1.1 software interface. The 'Design Options' dialog box is open on the right side. The 'Allow Flexible Computation for Thick Overlays on PCC' option is highlighted with a red arrow and set to 'Yes'. The 'Compute ACR for All Subgrade Categories' option is set to 'No'. The 'Design Options' dialog box also includes buttons for 'Show Advanced Options', 'Set as Program Default', 'Reset Default to Initial', 'Show/Hide Pavement Image', and 'Change Pavement Graphics'. The 'User Defined Aircraft Directory' is set to 'C:\Users\David Bril\Documents\My FAARFIELD\User Defined Aircraft\'. The 'Design Options' dialog box is titled 'Design Options' and has a 'Notes' tab at the bottom.

The main window shows the 'Structure' tab with the following data:

Material	Thickness (mm)	E (MPa)	CBR
P-401/P-403 HMA Surface	102	1,378.95	
P-401/P-403 HMA Stabilized	127	2,757.90	
P-209 Crushed Aggregate	681	435.58	
Subgrade		48.61	4.7

The 'Design Life (Years)' is set to 20. The 'P/TC Ratio' is set to 1. 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 (mm): 909'. The 'Traffic' section shows a table of aircraft data.

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm²)	A (ft)
S-30	13,608	8,000	0	160,000	0	0	3.7	517.11	0.95	312	500	122,580	42
Fokker-F-100	44,452	6,500	0	130,000	0	0	2.07	1043.63	0.95	281	450	99,204	64
B737-300	62,822	5,000	0	100,000	0	0	2.18	1370.99	0.95	291	466	106,724	65
B767-300 ER	158,757	3,200	0	64,000	0	0	1.13	1168.60	0.95	355	568	158,205	86
A380-800 WW000	544,310	400	0	8,000	0.36	0.4	1.19	1455.74	0.38	372	596	174,171	94
A380-800 WW000 Belly	544,310	400	0	8,000	0.02	0.76	0.88	1455.74	0.57	372	596	174,171	0

# Run Overlay Thickness Design

Click "Run"

**Structure**

Job Name: BKK Workshop Thickness Design Run Status Gear Structure

Structure Name: HMA Overlay Example Include in Summary Report Add To Batch

Pavement Layers

Pavement Type: HMA Overlay on Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-401/P-403 HMA Overlay	305	1,378.95		
P-501 PCC Surface	360	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20 SCB: 80 Percent CDFU: 100

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 (mm): 992

**Traffic**

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear All Aircraft from List Remove Selected Aircraft from Structure Delete Aircraft Mix File

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	CDF Max for Airplane	P/C Ratio	Tire Pressure (kPa)	Percent GW on Gear	Tire Contact Width (mm)	Tire Contact Length (mm)	Tire Contact Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	0	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	0	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	0	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0	0	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0	0	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0	0	0	1455.74	0.57	372	596	174,171
B777-300	263,083	1,500	0	30,000	0	0	0	1298.75	0.95	354	566	157,264

**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

Change Pavement Graphics

User Defined Aircraft Directory: C:\Users\David Brill\Documents\My FAARFIELD\User Defined Aircraft\ Change Aircraft Directory

Design Options Notes

# Design Complete

FAARFIELD overlay thickness requirement = 95 mm (Specify 100 mm)

**Structure**

Job Name: BKK Workshop Thickness Design Run

Structure Name: HMA Overlay Example Include in Summary Report Add To Batch

Pavement Layers

Pavement Type: HMA Overlay on Rigid

Material	Thickness (mm)	E (MPa)	k (MN/m <sup>3</sup> )	R (MPa)
P-401/P-403 HMA Overlay	95	1,378.95		
P-501 PCC Surface	360	27,579.04		4.80
P-306 Lean Concrete	127	4,826.33		
P-209 Crushed Aggregate	200	167.17		
Subgrade		47.00	25.3	

Select As The Design Layer Delete Selected Layer

Design Life (Years): 20 SC: 80 Percent CDF: 100

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 (mm): 782

**Traffic**

Stored Aircraft Mix: BKK Example Save Aircraft Mix to File Clear Aircraft

Airplane Name	Gross Taxi Weight (kg)	Annual Departures	Annual Growth (%)	Total Departures	CDF Contributions	Airplane	P/C Ratio	kPa	on Gear	Width (mm)	Length (mm)	Area (mm <sup>2</sup> )
S-30	13,608	8,000	0	160,000	0	0	3.7	517.11	0.95	312	500	122,580
Fokker-F-100	44,452	6,500	0	130,000	0	0	2.07	1043.63	0.95	281	450	99,204
B737-300	62,822	5,000	0	100,000	0	0	2.18	1370.99	0.95	291	466	106,724
B767-300 ER	158,757	3,200	0	64,000	0	0.01	1.13	1168.60	0.95	355	568	158,205
A380-800 WW000	544,310	400	0	8,000	0	0.15	1.19	1455.74	0.38	372	596	174,171
A380-800 WW000 Belly	544,310	400	0	8,000	0.98	0.99	0.88	1455.74	0.57	372	596	174,171

User Defined Aircraft Directory: C:\Users\David Brill\Documents\My FAARFIELD\User Defined Aircraft\ Change Aircraft Directory

Design Options Notes

# 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, Harold Honey, Jeff Crislip, Harold Muniz-Ruiz

ARA:  
Tim Parsons; Richard Speir; Dr. Ali Z. Ashtiani; Dr. Kairat Tuleubekov



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