

# FAARFIELD 1.41

## HMA Overlay Example

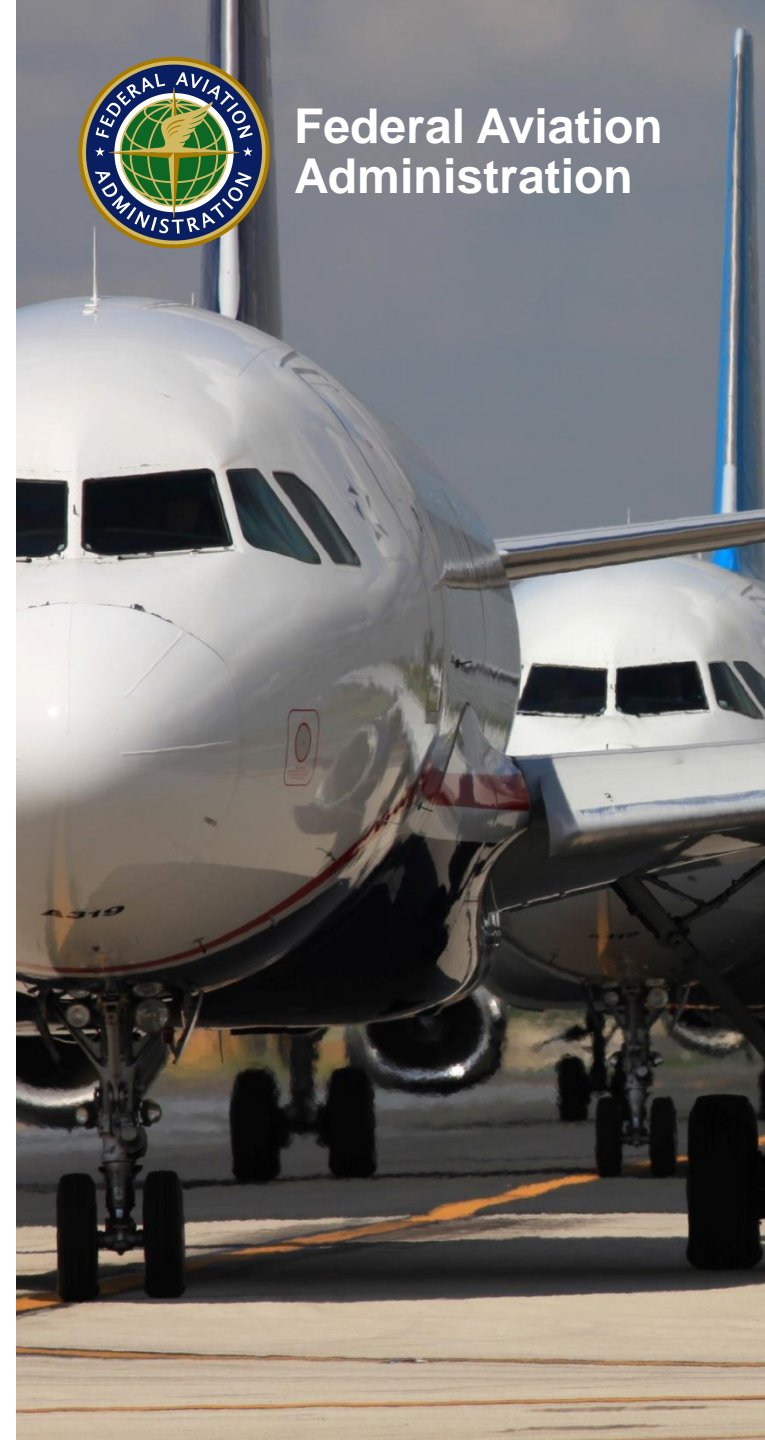
Presented to: XIII ALACPA Seminar on Airport Pavements  
Panama City

By: David R. Brill, P.E., Ph.D.

Date: 1 December 2016

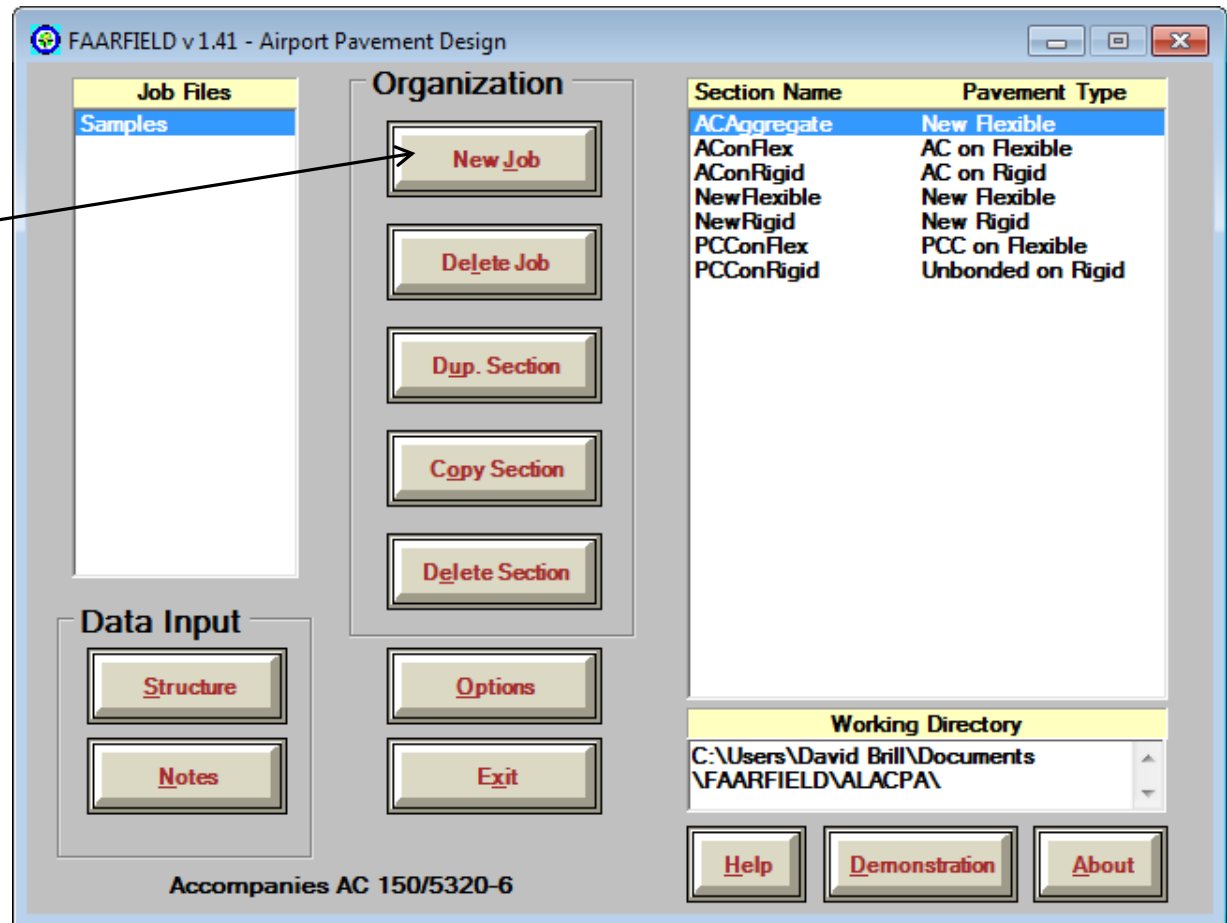


Federal Aviation  
Administration



# Start FAARFIELD

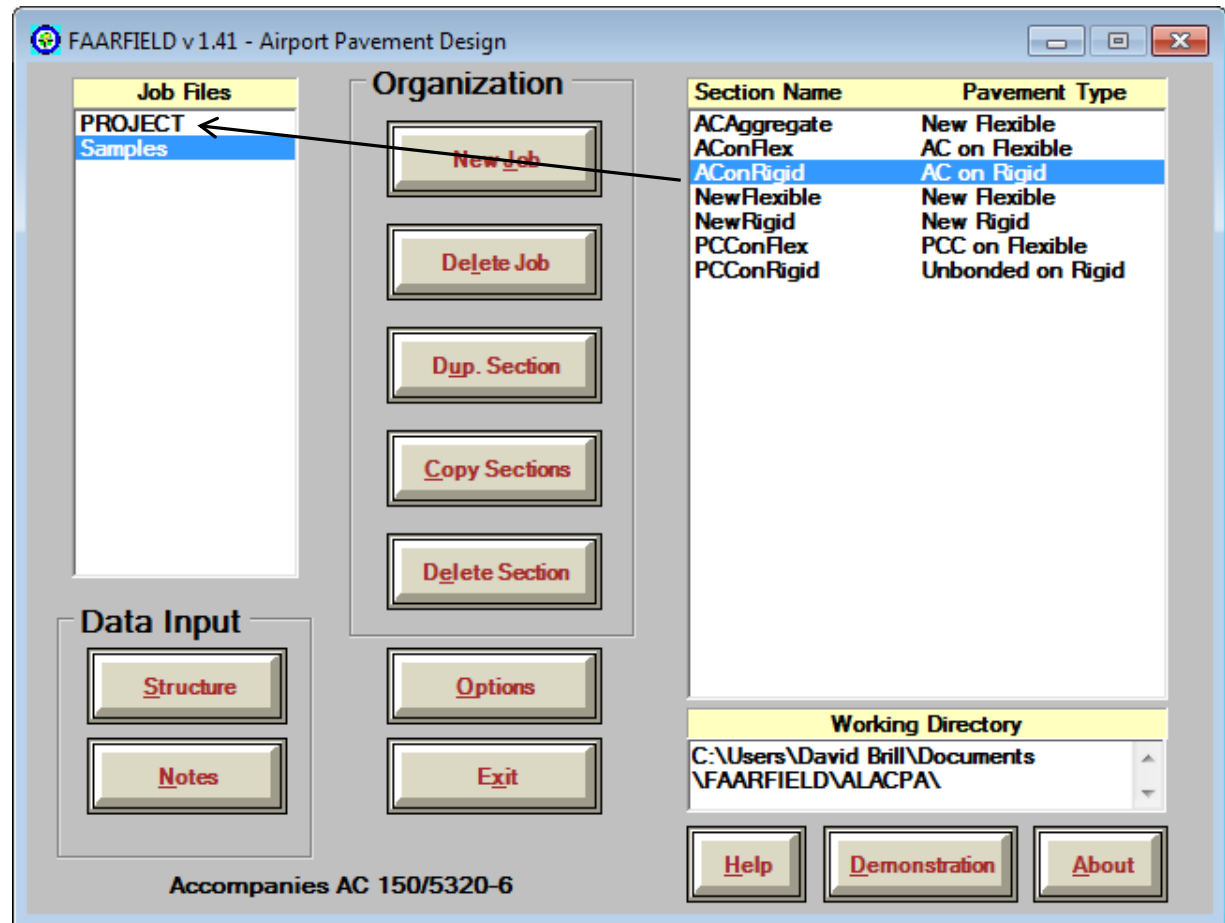
Create a new job called PROJECT.



# Copy an Overlay Section

In the **SAMPLES** job,  
copy the section  
**AConRigid** to  
**PROJECT**.

(drag and drop)



# Modify the Section

In job PROJECT, select Section AConRigid.

Click on Modify.

Modify the section until it appears like the image at right:

Overlay: 300 mm P-401  
PCC Surface: 400 mm P-501  
(R = 4.50 MPa)  
Base: 125 mm P-403  
Subbase: 300 mm P-209  
Subgrade: E = 50.0 MPa

Existing PCC: SCI = 80

Click “End Modify.”

FAARFIELD v 1.41 - Modifying Section AConRigid in Job PROJECT

Section Names  
AConRigid

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	300.0	1,378.95
PCC Surface	400.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	517.11
Subgrade	k = 26.6	50.00

Total thickness to the top of the subgrade, t = 1,125.0 mm

Status  
Airplane

Back Help Life **End Modify** Add/Delete Layer Save Structure

# Airplane Screen

Click on “Airplane.”

Note that the B747-200B consists of 2 lines, for the Wing and Belly gears. These lines are interlinked. Changing the gross weight or annual departures on either line affects the other.

This is a change from version 1.305 (for B747 or A380 series).

For this example, use the default traffic mixture.

FAARFIELD v 1.41 - Create or Modify Airplanes for Section AConRigid in Job PROJECT

Airplane Name (4)	Gross Taxi Weight (tns)	Annual Departures	% Annual Growth	De
DC 10-10	207.745	2,263	0.00	45
B747-200B Combi Mixed	395.986	832	0.00	10
B747-200B Combi Mixed Belly	395.986	832	0.00	10
B777-200 ER	287.804	425	0.00	8

Buttons: Add, Remove, Save List, Clear List, Save to Float, Add Float, Back, Help, CDF Graph, View Gear

Float Airplanes

# Run Overlay Design

Click Back to return to Structure Screen.

Click Design Structure to execute design.

FAARFIELD v 1.41 - Modify and Design Section AConRigid in Job PROJECT

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	300.0	1,378.95
PCC Surface	400.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	517.11
Subgrade	k = 26.6	50.00

Total thickness to the top of the subgrade, t = 1,125.0 mm

Buttons: Airplane, Back, Help, Life, Modify Structure, Design Structure, Save Structure

# Final Overlay Design

Final HMA overlay thickness = 145.2 mm

Design would specify 150 mm.

Now, what if the HMA overlay is very thick relative to the existing concrete slab?

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	145.2	1,378.95
PCC Surface	400.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	200.07
Subgrade	k = 26.6	50.00

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Design Stopped 73.47; 72.83

N = 1; Str Life = 20.0 yrs; t = 970.2 mm

# Thick HMA on Rigid Overlays

- **Refer to AC 150/5320-6F, 4.10.5:**

## 4.10.5 Treatment of Thick HMA Overlays on Existing Rigid Pavements.

For HMA overlay thickness, FAARFIELD assumes the existing rigid pavement supports load through flexural action. As the overlay thickness increases, the existing rigid pavement will tend to act more like a high quality base material. As the overlay thickness approaches the thickness of the rigid pavement, it may be more economical to treat the design as a new flexible pavement design on a high quality base material. In FAARFIELD options screen, one of the general options is to allow flexible computation for Thick Overlays. If this option is selected, FAARFIELD will do both computations and report out the thinner HMA overlay.

- **When the overlay thickness exceeds the existing slab thickness, the alternate flexible design option may be more economical.**
- **FAARFIELD 1.41 will make this determination automatically, if the option is selected.**

# FAARFIELD Options Screen

The screenshot shows the 'Options' dialog box with the following sections:

- Pavement Structure Options**
  - New Flexible**
    - HMA on Flexible
    - New Rigid
    - PCC on Flexible
    - 0.005 CDF Tolerance
  - HMA on Rigid**
    - Unbonded on Rigid
    - Part Bonded on Rigid
    - 0.40 Life Tolerance [years]
  - New Flexible**
    - HMA on Flexible
    - HMA CDF
    - Alternate Subgrade
  - New Flexible**
    - Enable Automatic Base Design
  - Unbonded on Rigid**
    - Part Bonded on Rigid
    - 16 NSection Parameter
  - Partially Bonded Overlay on Rigid**
    - Enabled
- General Options**
  - Units:  English  Metric
  - Batch Mode
  - Out File
  - Allow Flexible Computation for Thick Overlays in PCC
  - Save Notes to PDF
  - Compute Compaction Requirements

Buttons: OK, Restore Default

Allow Flexible Computation for Thick Overlays on PCC

This option is "ON" by default.

# Modify the Section

Click on **Modify**.

Change the PCC thickness from 400 mm to 150 mm.

All other inputs are the same.

Click “**End Modify**.”

FAARFIELD v 1.41 - Modifying Section AConRigid in Job PROJECT

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	145.2	1,378.95
PCC Surface	150.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	200.07
Subgrade	k = 26.6	50.00

N = 1; Str Life = 20.0 yrs; t = 720.2 mm

Design Stopped  
73.47; 72.83

Airplane

Back Help Life **End Modify** Add/Delete Layer Save Structure

# Run Overlay Design

Click Design Structure to execute the design.

FAARFIELD v 1.41 - Modify and Design Section AConRigid in Job PROJECT

Section Names  
AConRigid

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	145.2	1,378.95
PCC Surface	150.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	200.07
Subgrade	k = 26.6	50.00

N = 1; Str Life = 20.0 yrs; t = 720.2 mm

Design Stopped  
73.47; 72.83

Airplane

Back Help Life Modify Structure Design Structure Save Structure

# Alternate Overlay Thickness

Final HMA overlay thickness = 154.8 mm

Design would specify 160 mm.

Click on “Back” and then “Notes” to see the design output.

FAARFIELD v 1.41 - Modify and Design Section AConRigid in Job PROJECT

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	154.8	1,378.95
PCC Surface	150.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	200.07
Subgrade	k = 26.6	50.00

N = 1; Str Life = 19.9 yrs; t = 729.8 mm

Design Stopped 55.96; 55.74

Airplane

Back Help Life Modify Structure Design Structure Save Structure

# Design Information

**“Overlay thickness was determined using a flexible design procedure, considering the existing PCC as a high-stiffness base layer. CDF is determined for the top of the subgrade.”**

FAARFIELD v 1.41 - Notes and Information for Job PROJECT

Section Names  
AConRigid

Design Information for Section AConRigid

FAARFIELD v 1.41 - Airport Pavement Design

Section AConRigid in Job PROJECT.  
Working directory is C:\Users\David Brill\Documents\FAARFIELD\ALACPA\

The structure is AC Overlay on Rigid.  
SCI of the existing pavement = 80.  
Design Life = 20 years.  
A design for this section was completed on 11/14/16 at 16:57:03.

Overlay thickness was determined using a flexible pavement design procedure, considering the existing PCC as a high-stiffness base layer. CDF is determined for the top of the subgrade. Refer to AC 150/5320-6, paragraph 405, for additional information. (c)

Pavement Structure Information by Layer, Top First

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R, MPa
1	P-401/ P-403 HMA Overlay	154.8	1,378.95	0.35	0.00
2	PCC Surface	150.0	27,579.03	0.15	4.50
3	P-401/ P-403 St (flex)	125.0	2,757.90	0.35	0.00
4	P-209 Cr Ag	300.0	200.07	0.35	0.00

Buttons: Back, Save PDF, Save XML, Save, Print, Design Info, Notes, Copy

# Standard Overlay Design

If you deselect the “Allow Flexible Computation” option, then the required HMA overlay thickness increases to 533 mm.

Try it yourself!

FAARFIELD v 1.41 - Modify and Design Section AConRigid in Job PROJECT

PROJECT AConRigid Des. Life = 20 SCI = 80 %CDFU = 100

Layer Material	Thickness (mm)	Modulus or R (MPa)
P-401/P-403 HMA Overlay	533.2	1,378.95
PCC Surface	150.0	4.50
P-401/P-403 St (flex)	125.0	2,757.90
P-209 Cr Ag	300.0	200.07
Subgrade	k = 26.6	50.00

N = 1; Str Life = 19.9 yrs; t = 1,108.2 mm

Design Stopped 54.99; 53.37

Airplane

Back Help Life Modify Structure Design Structure Save Structure

# Thank You! ¡Gracias!

<http://www.airporttech.tc.faa.gov/>

[david.brill@faa.gov](mailto:david.brill@faa.gov)

## Acknowledgments:

### FAA Airport Technology R&D Branch:

Dr. Michel Hovan, Branch Manager;

Jeff Gagnon, Airport Pavement Section Manager;

Dr. Navneet Garg; Al Larkin; Murphy Flynn; Ryan Rutter; Quinn Jia, Wilfredo Villafane

### FAA Airport Engineering Division:

Doug Johnson; Greg Cline

### SRA International:

Michael Collins; Dr. Izydor Kawa; Dr. Qiang Wang; Dr. Yuanguo Chen; Dr. Kairat Tuleubekov; Shawn Hershman; Jeff Stein

### Gemini:

Dr. Hao Yin

