FAARFIELD 2.0

Federal Aviation Administration

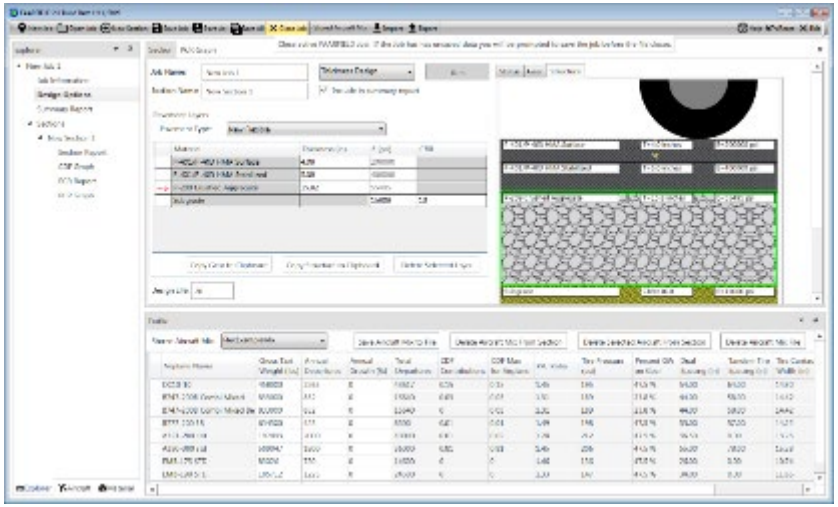
Presented to: REDAC Subcommittee on Airports

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

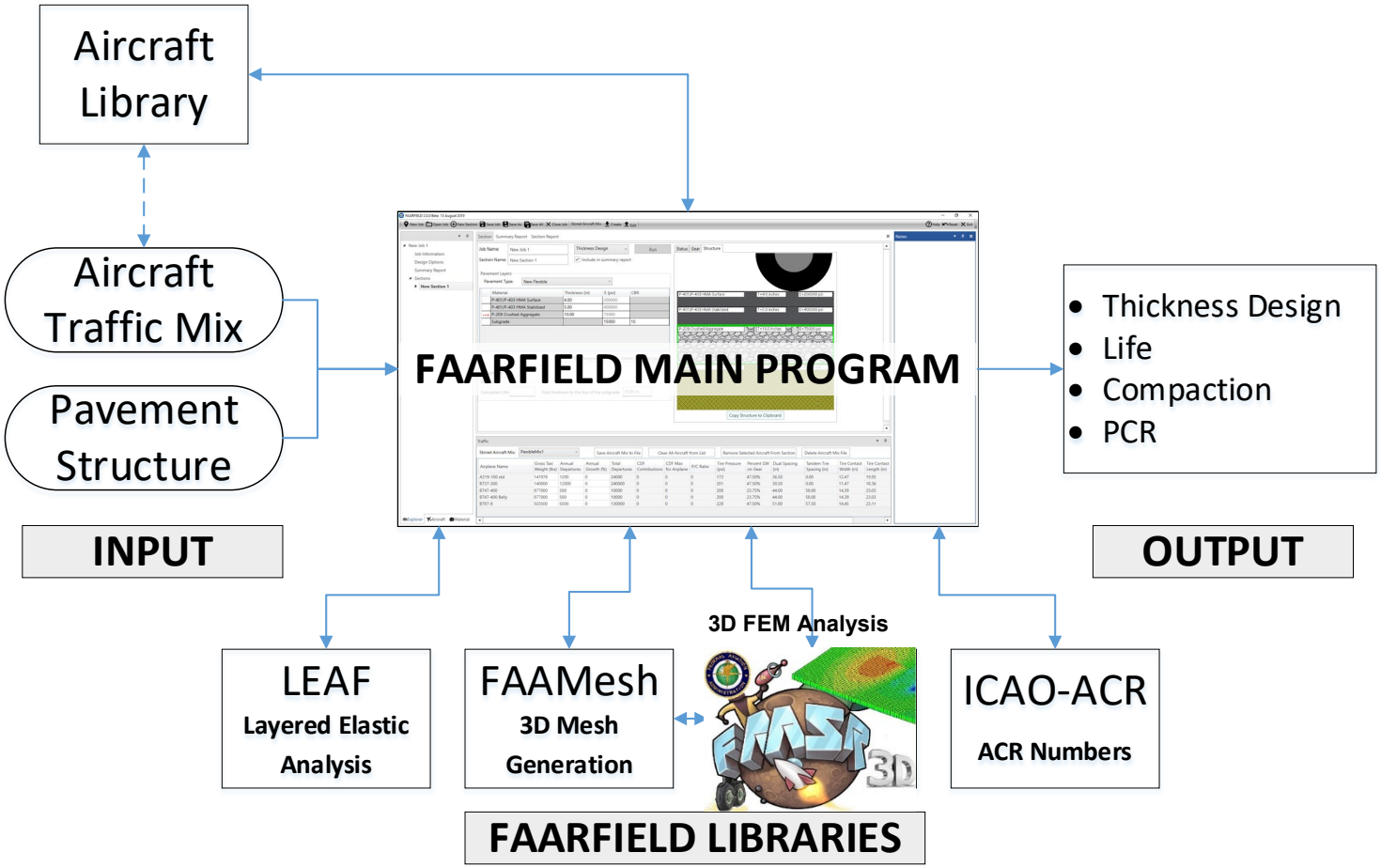
Date: 26 August 2020

FAARFIELD 2.0 Beta

- **Full rewrite of AC 150/5320-6G.**
  - Industry review ended 8/1.
  - Comments under review.
  - Includes FAARFIELD 2.0.
- **Major update from version 1.4:**
  - Redesigned user interface with improved screen flow.
  - Updated 3DFEM models.
  - Support for ICAO ACR-PCR.
  - New vehicle editor.
  - Updated aircraft library.
- **No change to thickness design requirements at this time.**

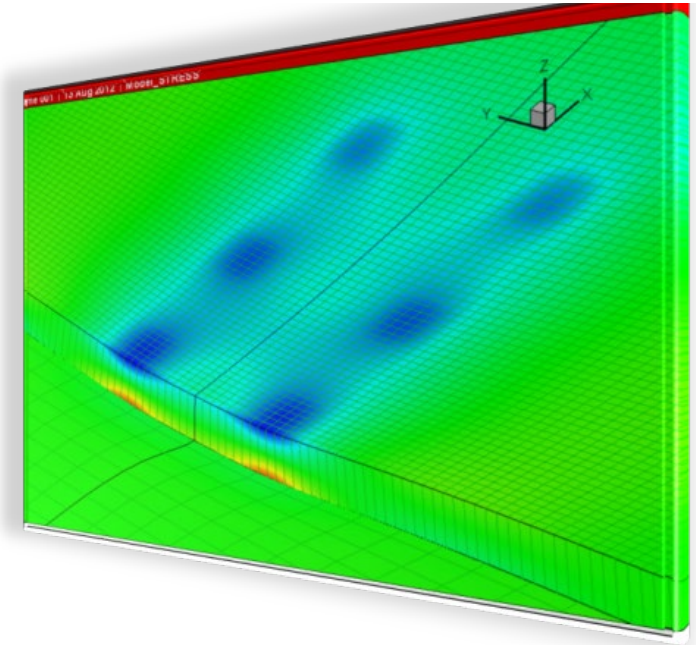


FAARFIELD 2.0 Organization



FAASR3D –
FAA Structural Analysis in 3D

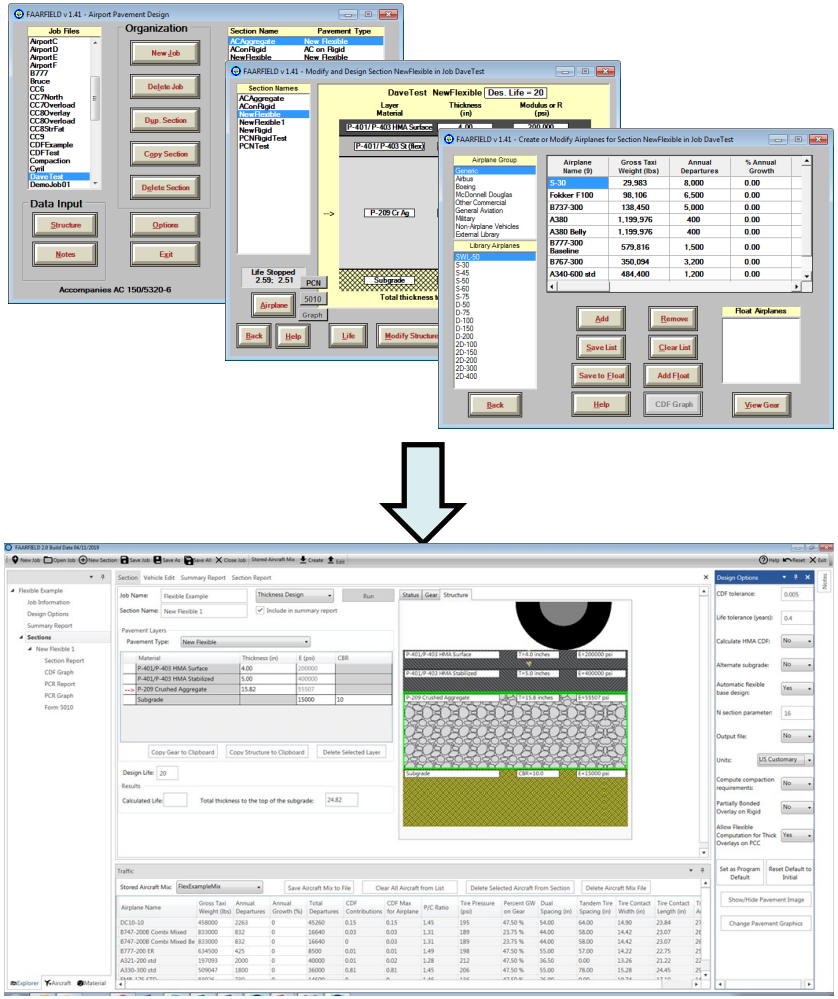
- **Visual Basic.NET library.**
- **Replaces obsolete NIKE3D Fortran program.**
  - Managed Code - compatible with Microsoft .NET memory management services.
  - Improves performance. Old code was subject to memory conflicts and crashing.
  - Freely distributable code.
- **Continued updates to improve speed & efficiency.**



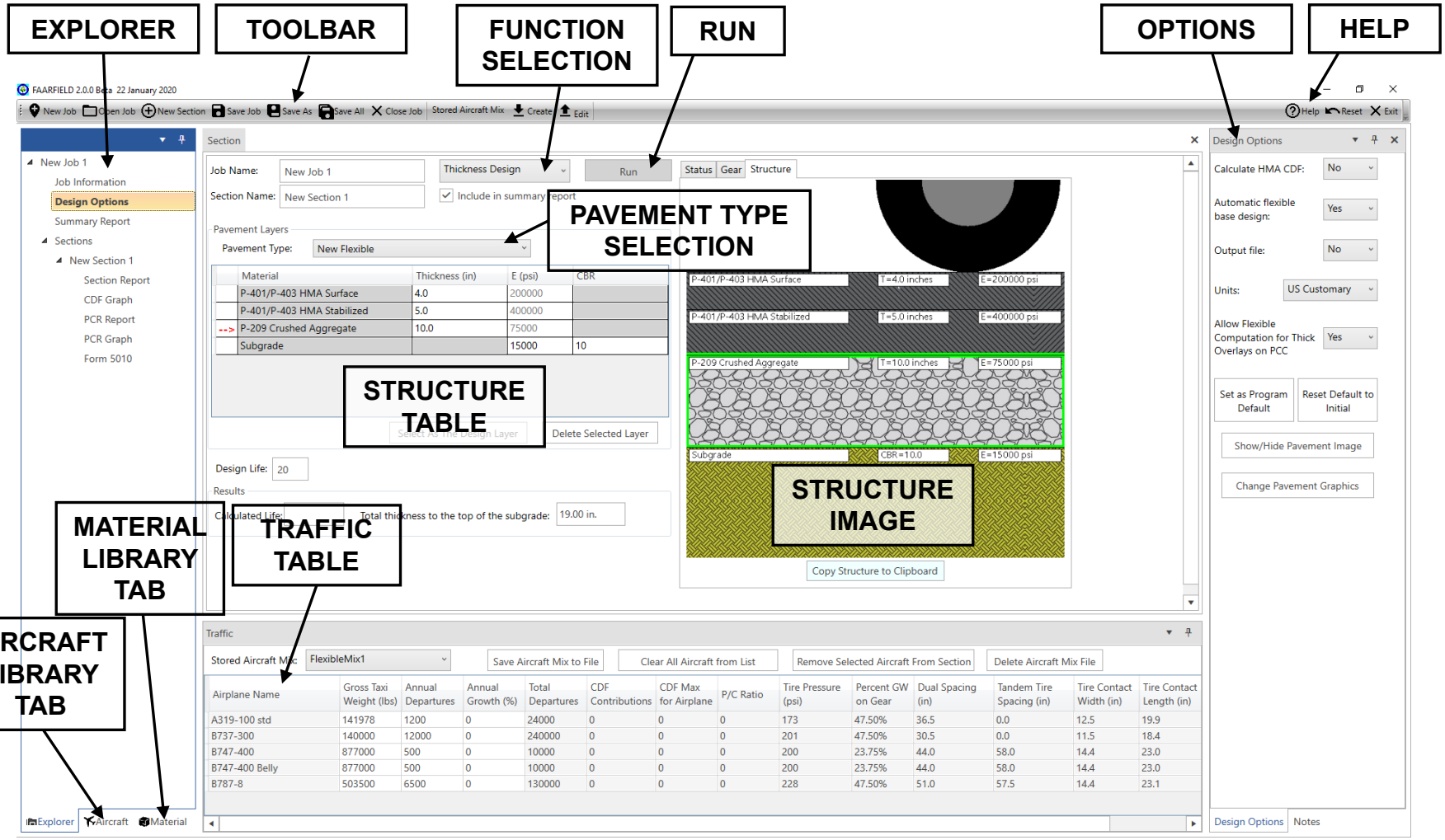
GUI Modernization

Major improvements:

- Easier job and section entry.
- Explorer-based navigation.
- Improved screen re-sizing and appearance.
- Improved flow between screens.
- Ability to store traffic mixes.
- Rationalized data file structure.
- On-demand report generation.
- Remove program logic from GUI controls.
- Etc.



FAARFIELD 2.0 GUI Layout

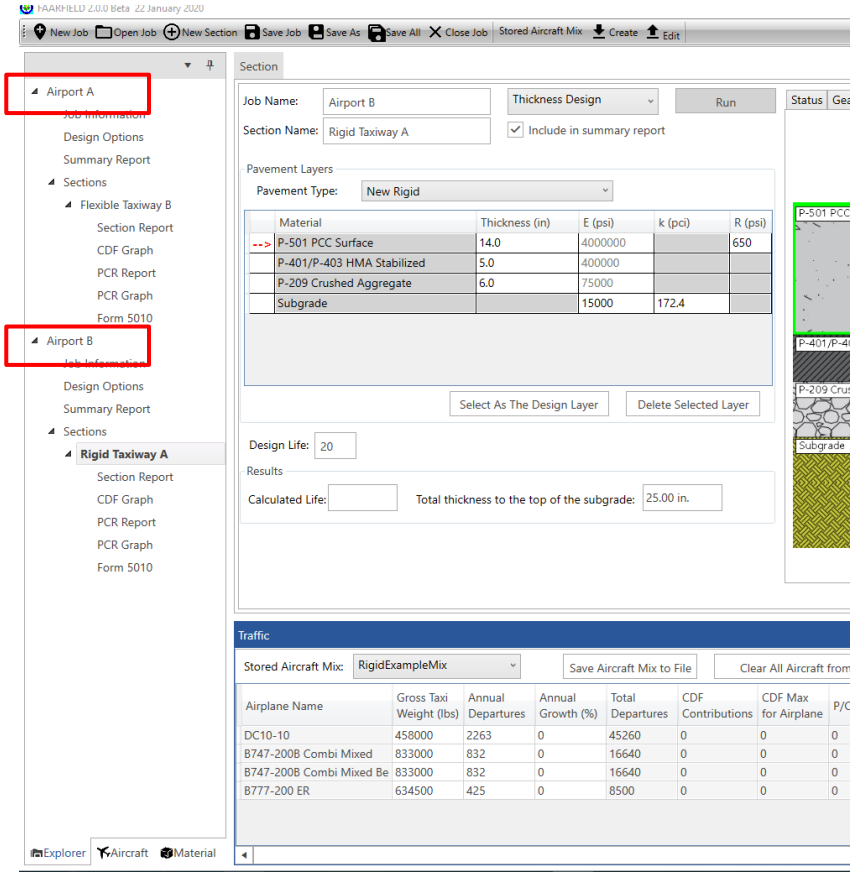


Features of Modernized GUI

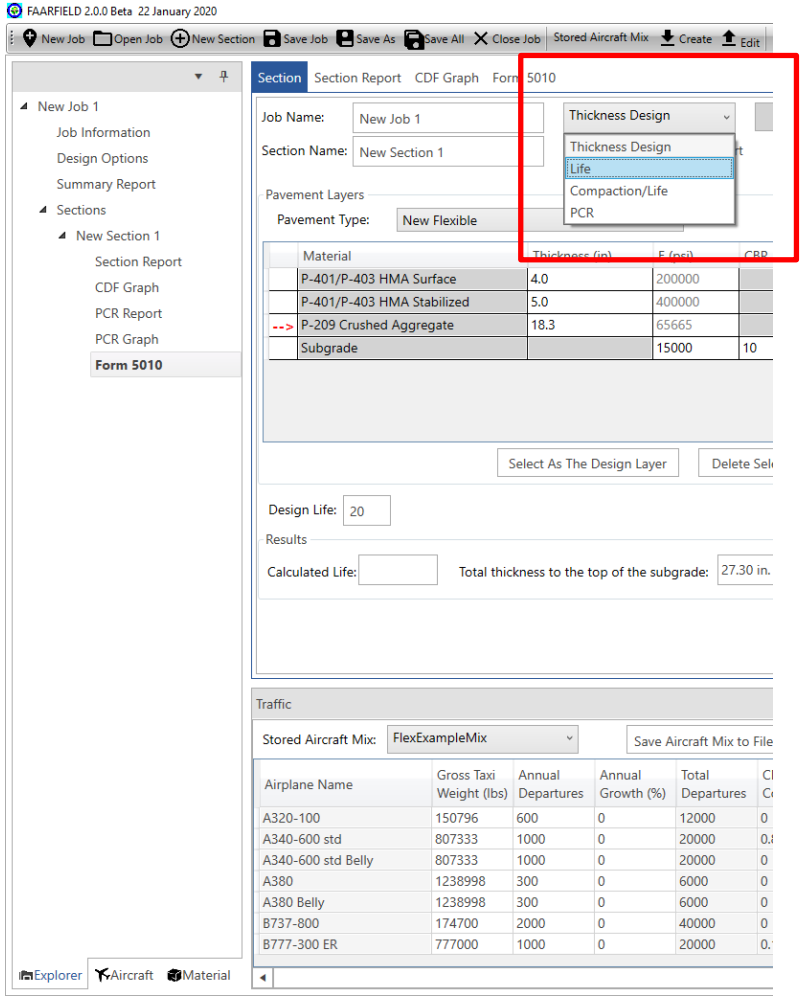
- **Multi-display interface.**
- **Highly configurable process flow.**
  - Consolidated data entry to single screen.
  - Open, resize, move, dock/undock, close screens independently.
  - Makes use of right-click context menus.
- **Resizable screens.**
- **Allows working with multiple jobs & sections.**
  - Switch between jobs/sections/pavement types with 1 click.
  - Cut and paste between jobs.
- **Standard Windows file management.**
  - Built-in Windows tools for saving/opening jobs.
  - Section and job names follow Windows standards.
- **Built-in standard pavement section library accessible from menu.**

Explorer Navigation

- **FAARFIELD 2.0 supports multiple jobs open at the same time.**
- **Use the Explorer to navigate between jobs, and display:**
  - Sections
  - Section Reports
  - PCR Reports/Graphs
  - 5010 Reports
  - Summary Reports (All sections in a job)

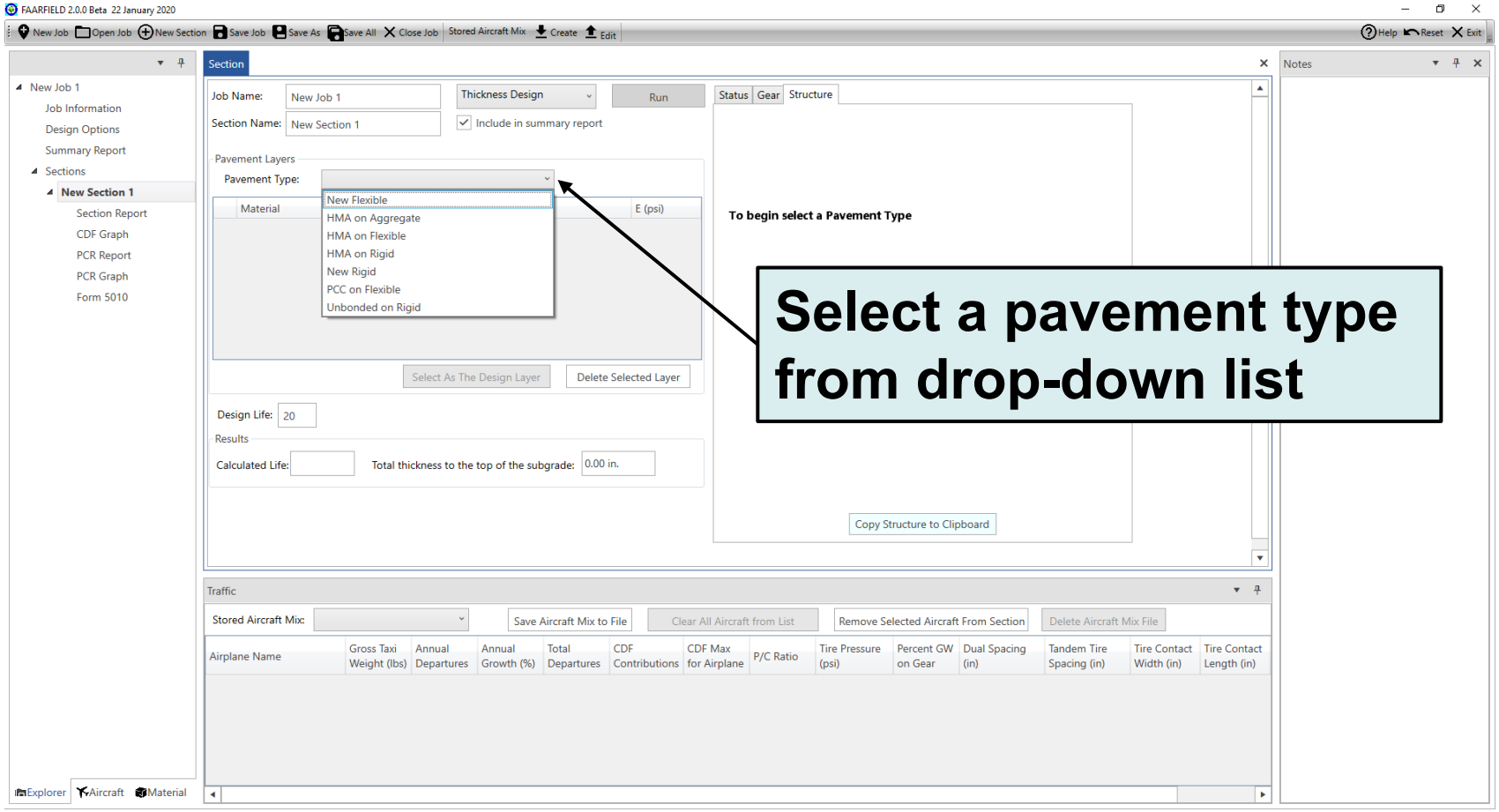


Four Functions in FAARFIELD 2.0

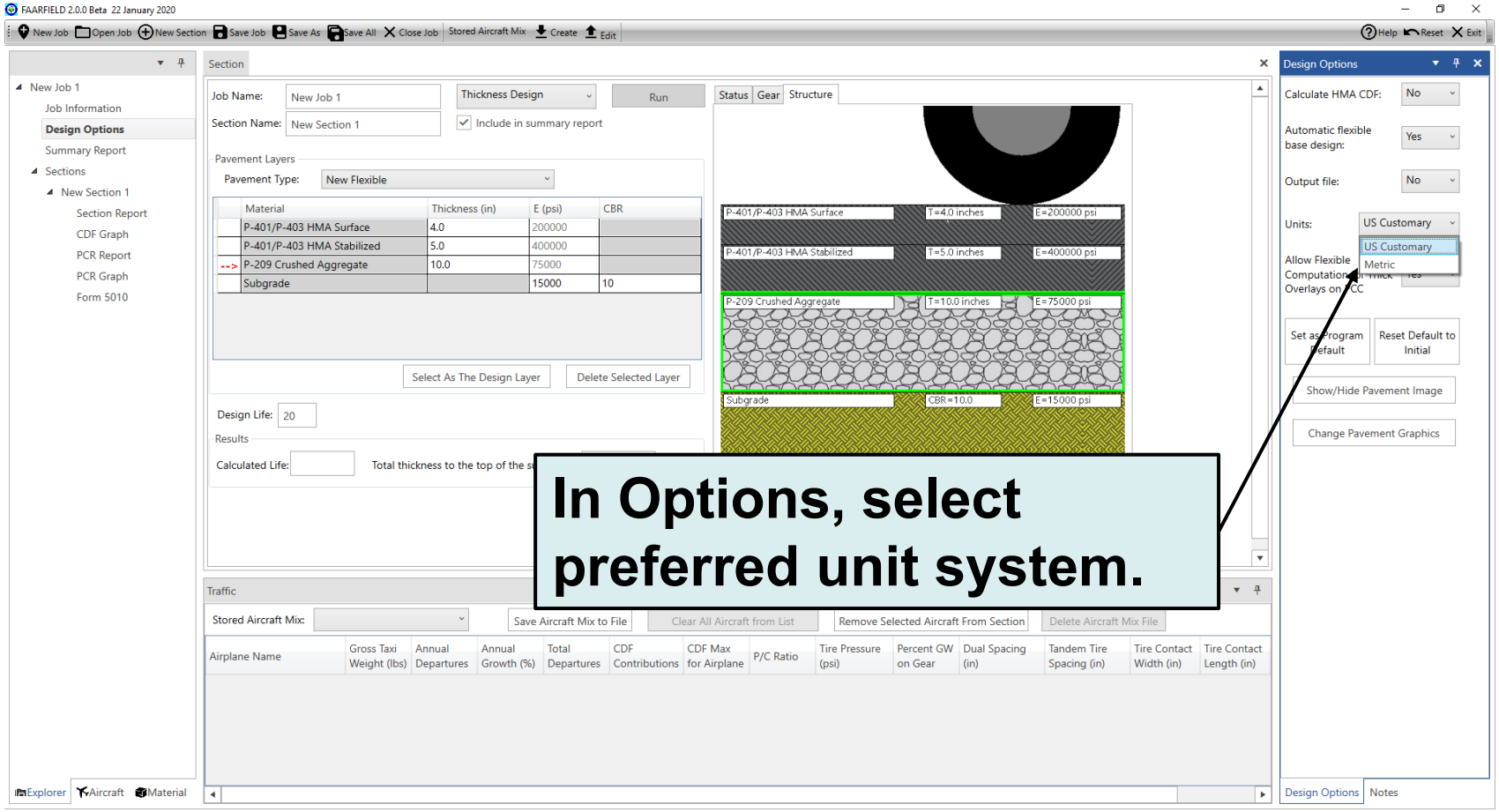


- **THICKNESS DESIGN – Compute required thickness per AC 150/5320-6.**
- **LIFE – Compute structural life for a given structure and traffic mix.**
- **COMPACTION – Compute subgrade compaction requirements per AC 150/5320-6 for a given structure and traffic mix. (Applies to completed designs.)**
- **PCR – Compute Pavement Classification Rating (PCR) for the structure and traffic mix.**

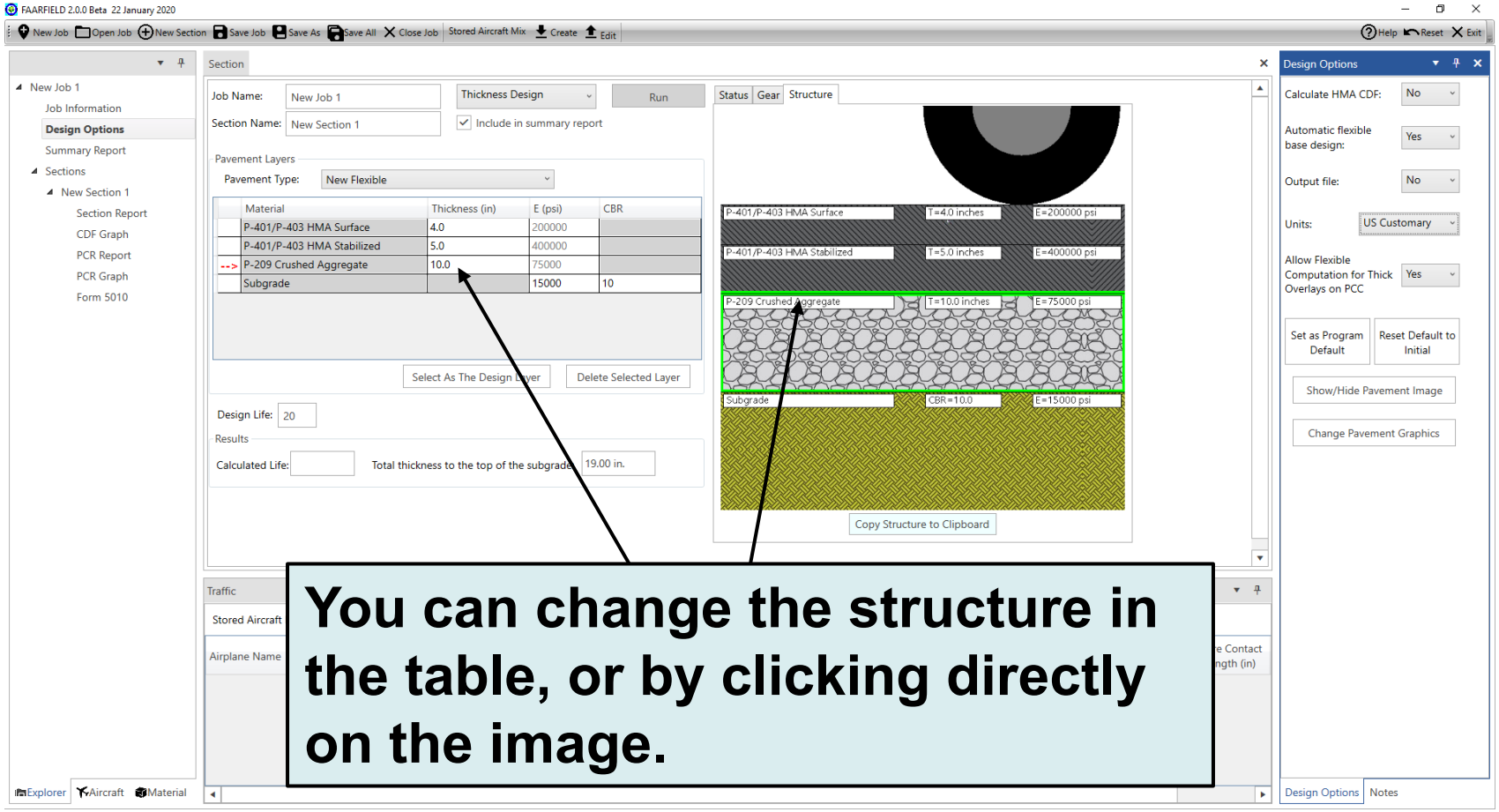
FAARFIELD 2.0 Starting Screen



FAARFIELD 2.0 Design Example

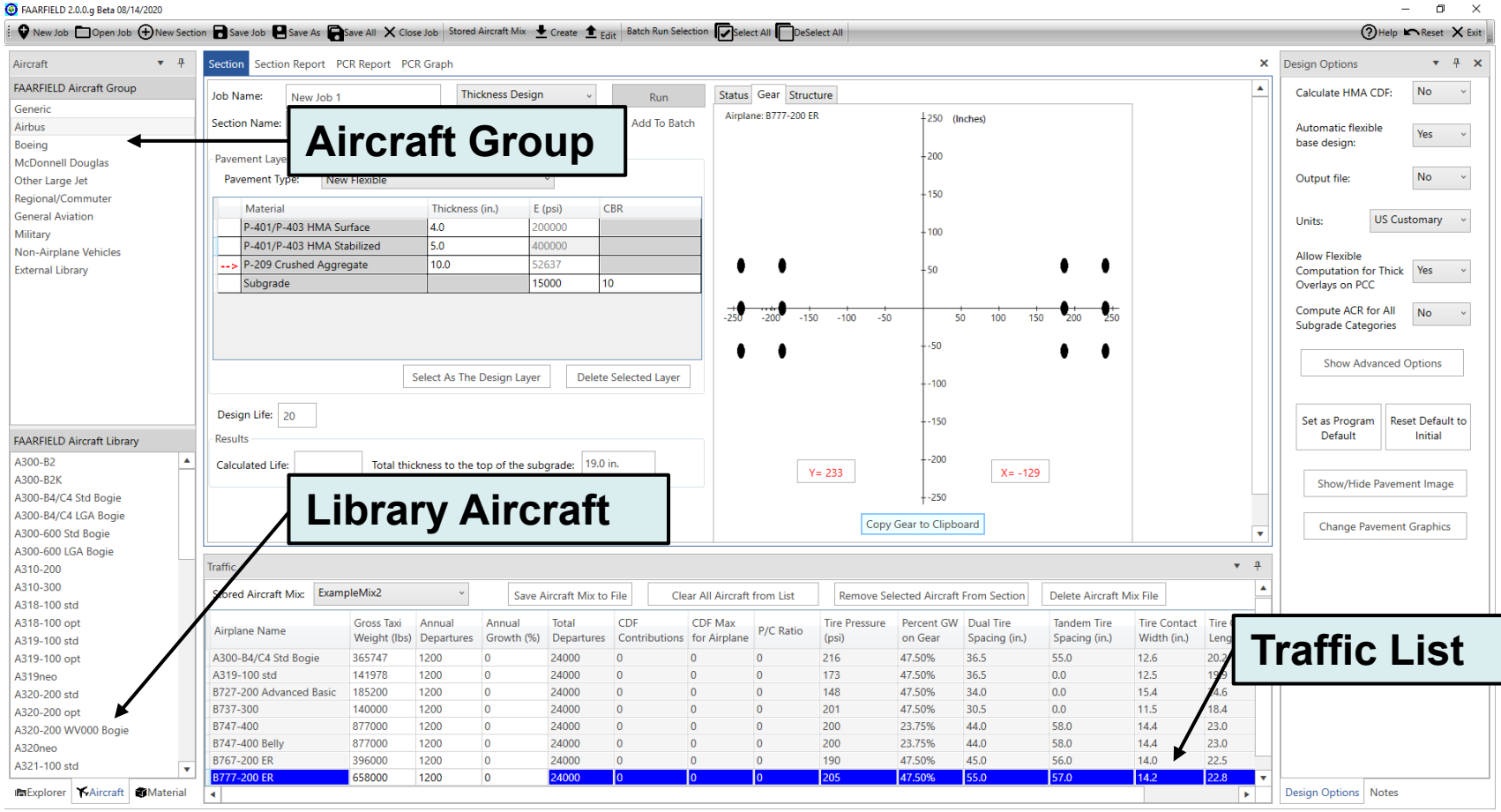


Pavement Structure



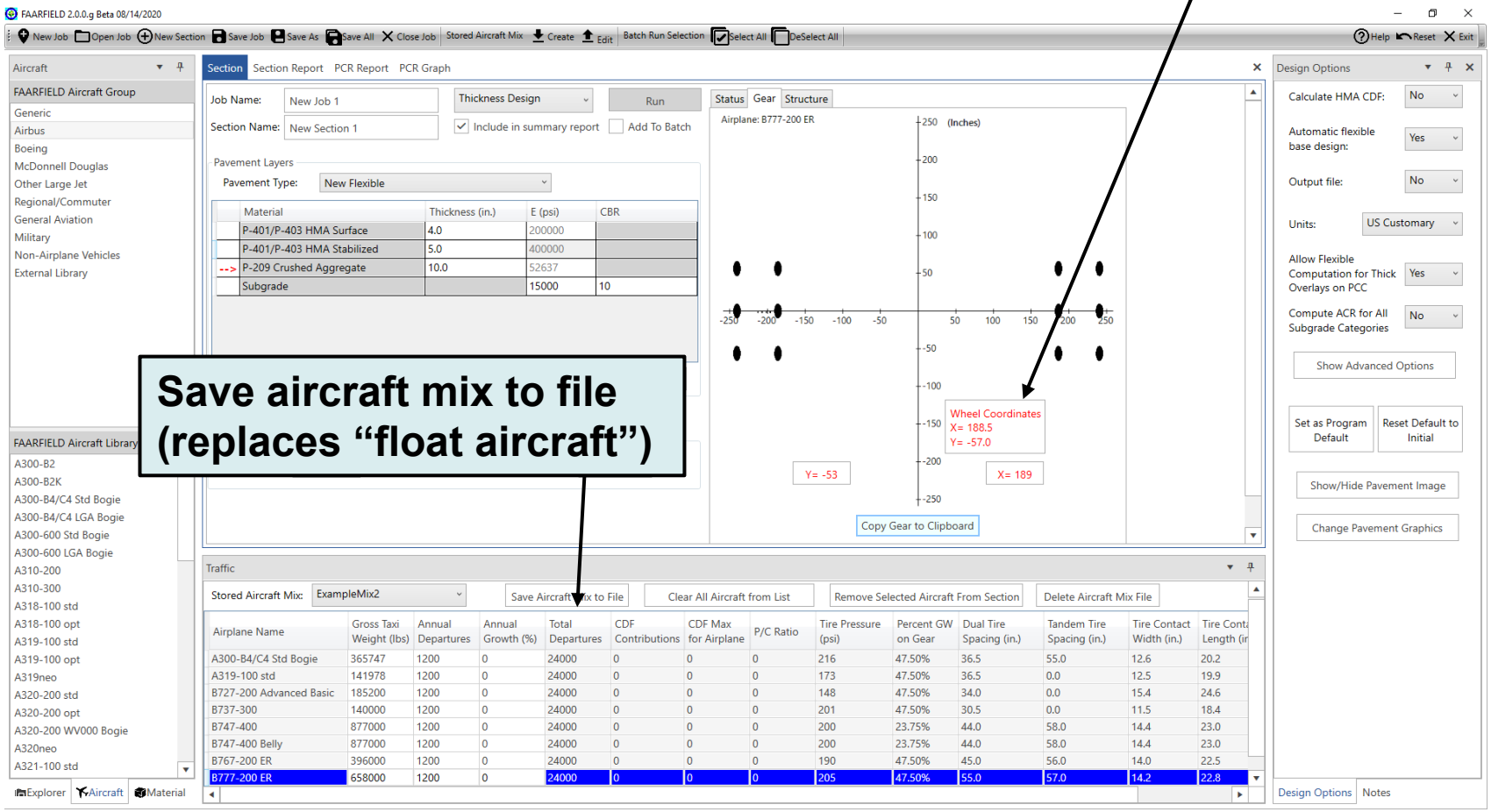
Aircraft Selection

Aircraft library has been completely reorganized and updated for the FAARFIELD 2.0 release!



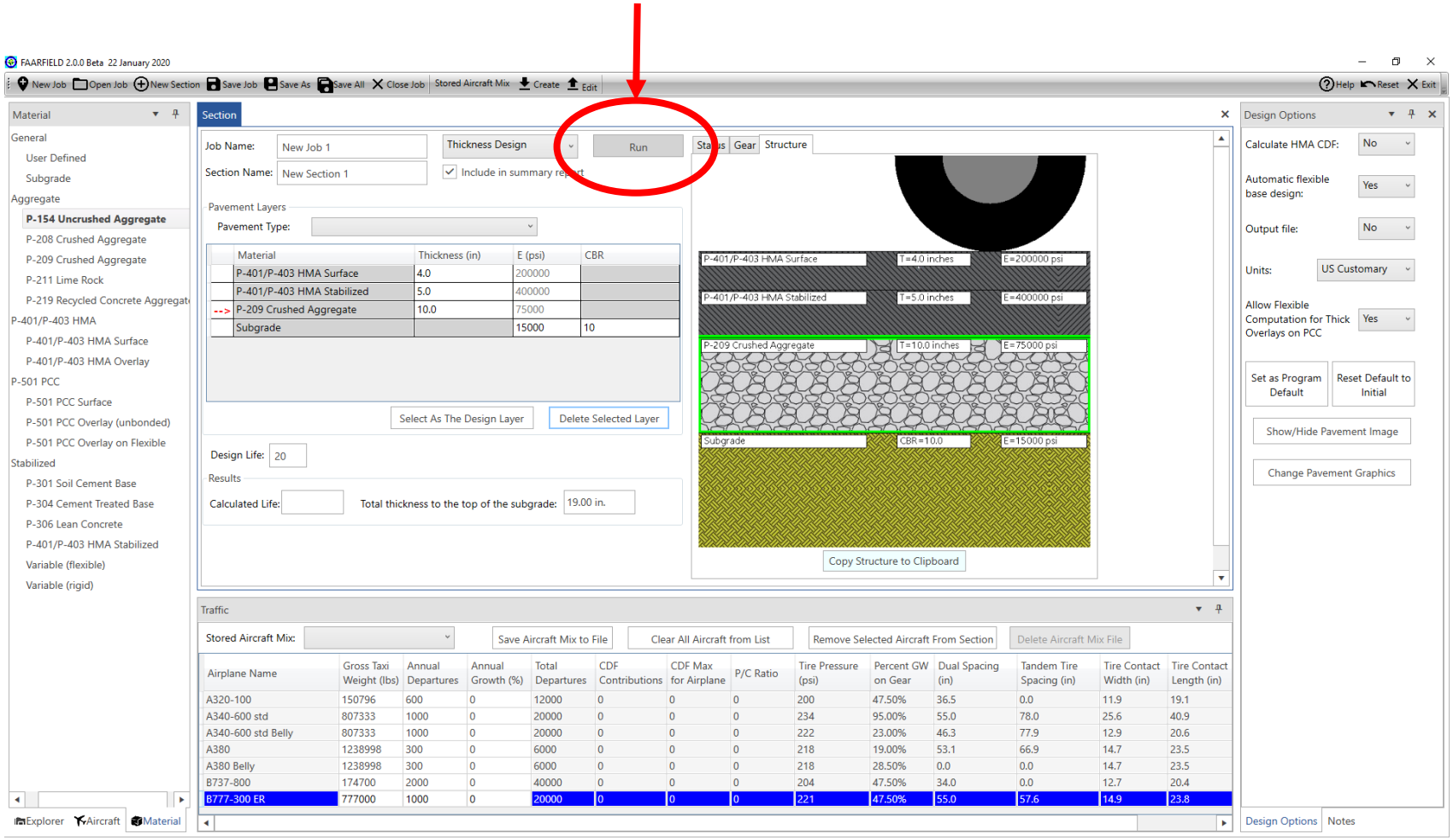
Aircraft Selection

Gear data displayed on screen (mouse over wheel to display coordinates)

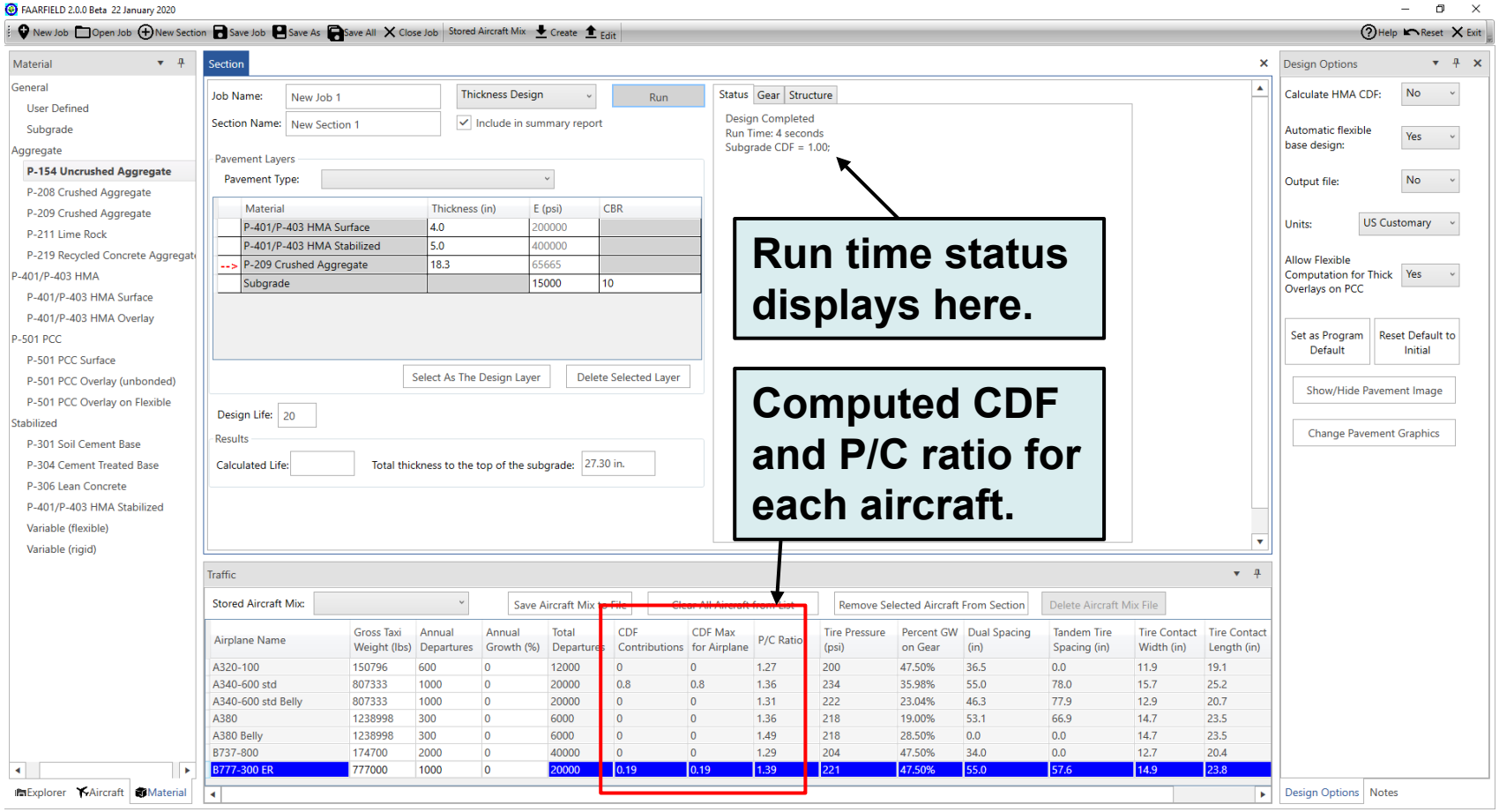


Save aircraft mix to file (replaces “float aircraft”)

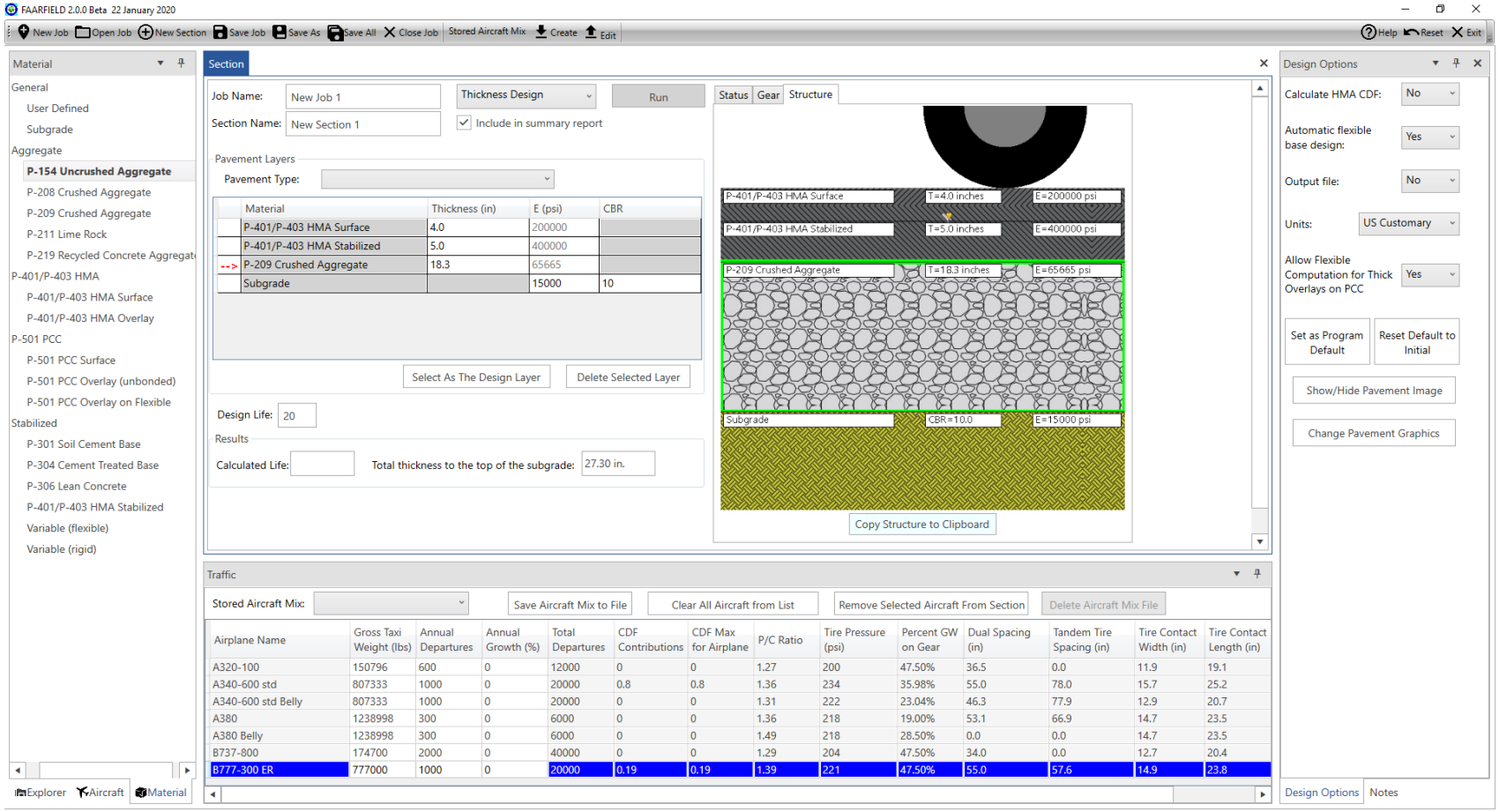
Run Thickness Design



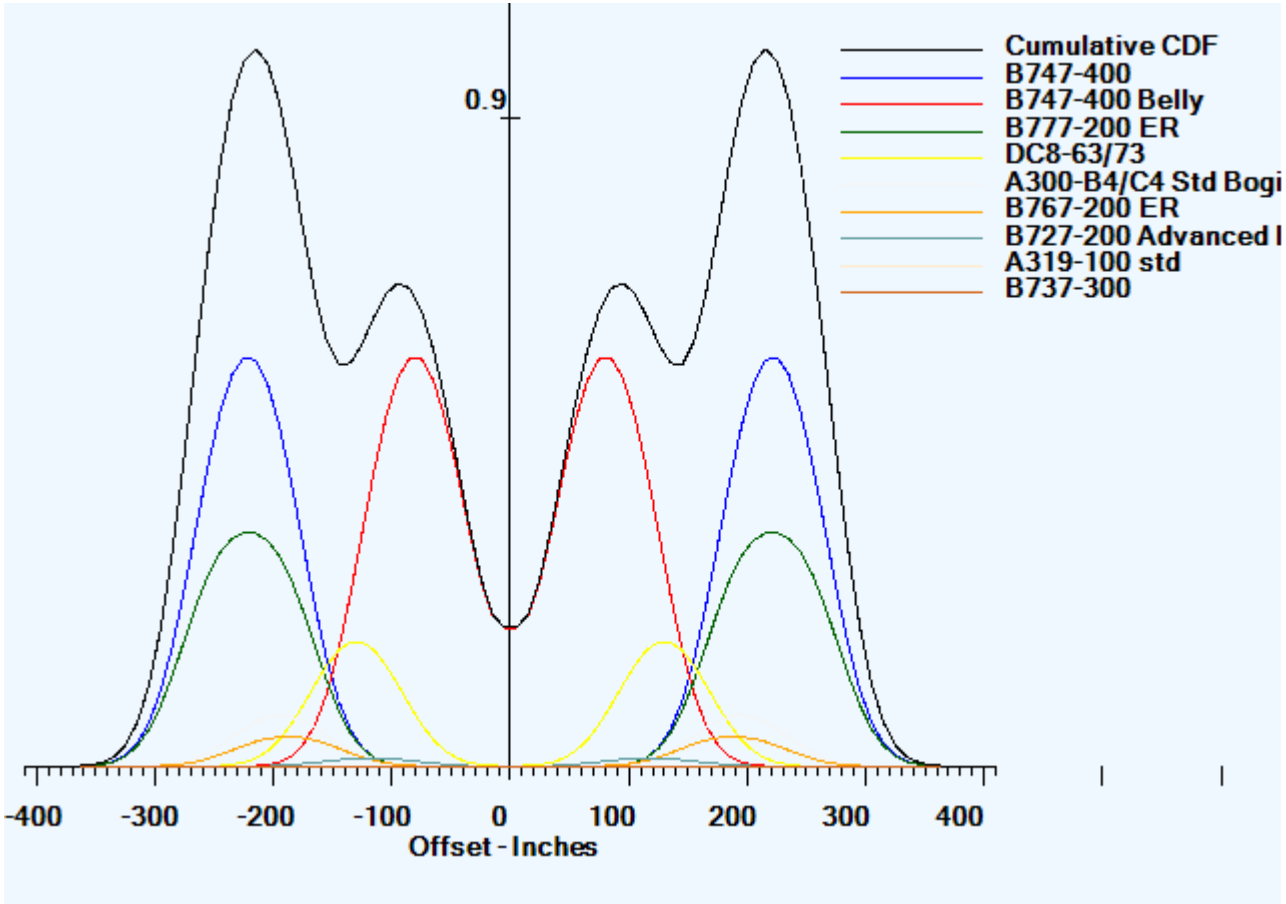
Design Complete



Design Complete

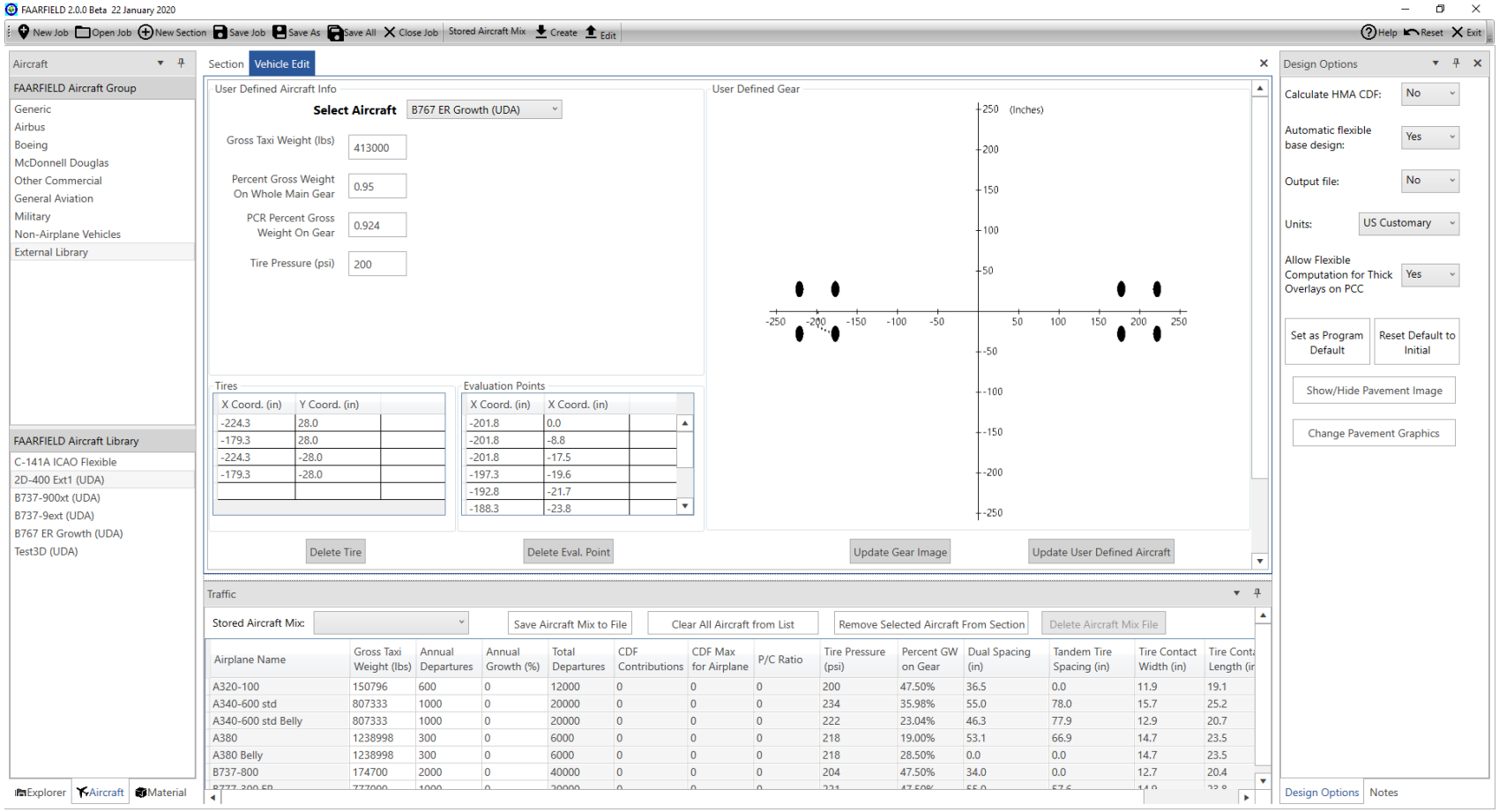


Cumulative Damage Factor (CDF)



User-Defined Aircraft Mode

Create, edit and save user-defined aircraft within the program.



User-Defined Aircraft

- **FAARFIELD treats UDA just like other library aircraft, except they have (UDA) appended to the aircraft name.**
- **UDA data are stored in files in:**
  C:\Users\[user]\Documents\My FAARFIELD\User Defined Aircraft
- **UDA data are also saved to the job file – useful if a job is sent to another user.**

ICAO ACR/PCR

- **ICAO Aerodromes Pavement Expert Group (APEG).**
  - Task Force Participants included the major aircraft manufacturers, ACI World, ICAO APEG
  - Started in 2011
  - Designated ACR-PCR (Aircraft Classification Rating – Pavement Classification Rating) System
- **Same concepts as current ACN-PCN method, but:**
  - Fully layered elastic-based.
  - Uses uniform standard subgrade categories for flexible and rigid.
  - NO alpha factor, layer equivalency factors, top-of-base k, etc.
- **FAA developed program ICAO-ACR.**
  - Visual Basic class library computes rigid & flexible ACRs.
  - Replacement for legacy ICAO ACN computer programs.
  - Open source library – supports linking to any PCN program.

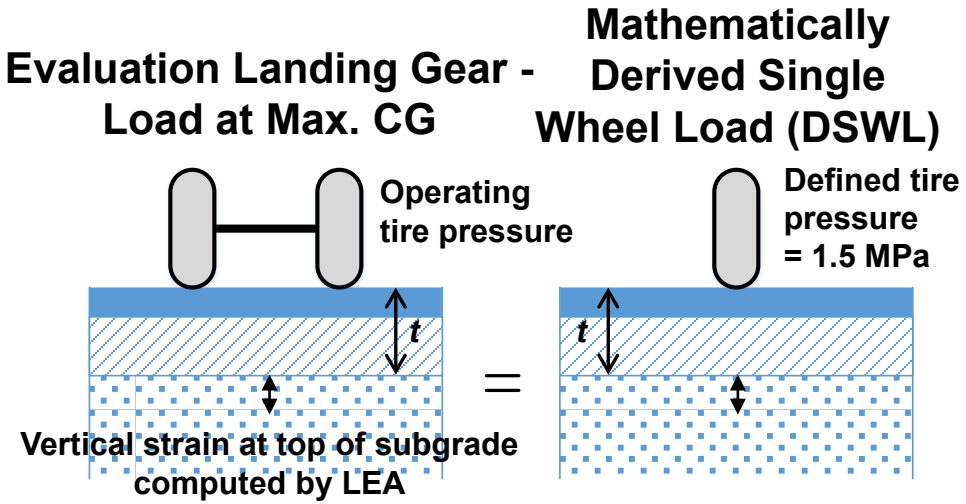
ACR/PCR Current Status

- **ICAO Air Navigation Committee (ANC) has recommend approval of the proposed amendment to Annex 14 on ACR-PCR.**
- **Proposal establishes four-year transition period from ACN-PCN to ACR-PCR:**
  - Effective date July 2020.
  - Full applicability November 2024(5?).
  - During transition, both systems will remain available.
- **FAA will update AC 150/5335-5.**
  - FAARFIELD 2.0 will calculate PCR.
  - COMFAA will no longer be updated.

ACR Methodology – Principles

Similar to ACN, except:

- **All structures are layered elastic (rigid and flexible).**
- **Retains 4 standard subgrade categories, but defined by modulus (*E*) not CBR or *k*.**
- **Flexible ACR considers <u>all</u> wheels in the main landing gear.**
- **Standard tire pressure 1.5 MPa.**
- **Standard coverages increased to 36,500 for flexible ACR.**
- **DSWL expressed in 100's (not 1000's) of kg. ***<u>ACR numerical values are approximately 10X higher than equivalent ACN</u>*.**



The ACR numerical value is defined as two times the DSWL (expressed in <u>hundreds</u> of kilograms)

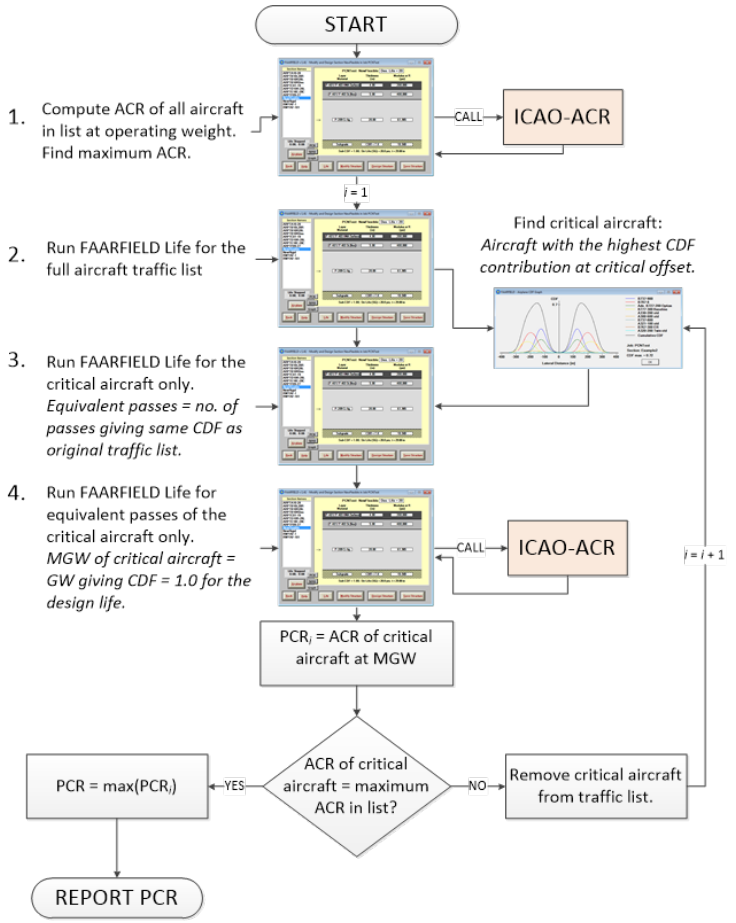
ACR-PCR Subgrade Categories

Category	A	B	C	D
Strength	High	Medium	Low	Ultra-Low
E Value, MPa	200	120	80	50
Range, MPa	$E \geq 150$	$150 > E \geq 100$	$100 > E \geq 60$	$60 > E$

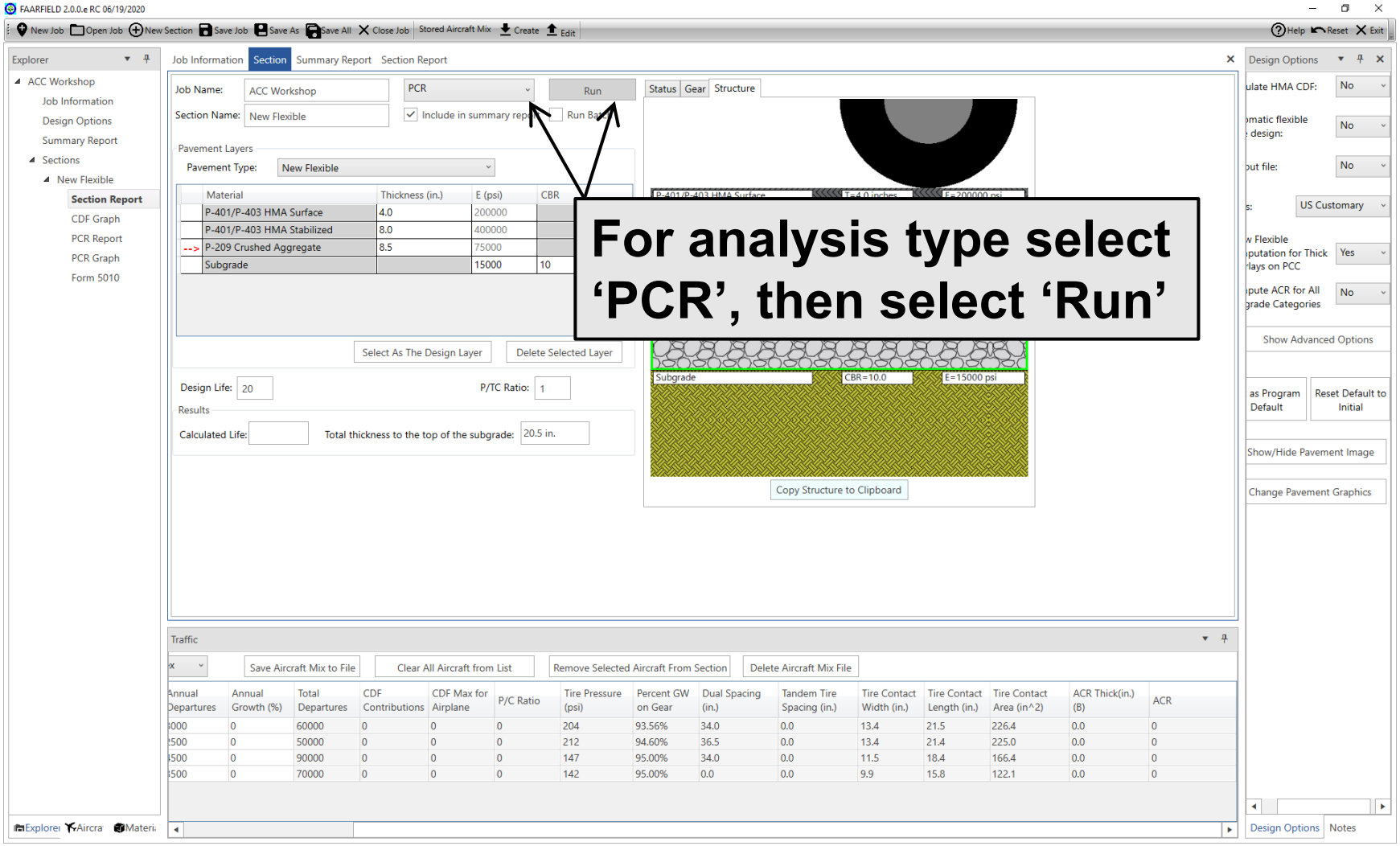
- **Categories are defined by *E*, not CBR or *k*.**
- **<u>Same categories for rigid and flexible pavements.</u>**
- **All values defined at top of subgrade.**

FAARFIELD 2.0 Can Provide PCR

- **Directly uses FAARFIELD structure and traffic list.**
- **Replacement for COMFAA 3.0 & support spreadsheets.**
- **Method yields uniquely defined PCR – no more looping through all aircraft in the list.**
- **Implemented in FAARFIELD 2.0**
  - Solves problem of computing PCR for mixed traffic (narrow bodies and LR aircraft) without unnecessary operating weight restrictions.
  - Seamlessly handles HMA overlays on flexible pavements.



FAARFIELD 2.0 PCR Example



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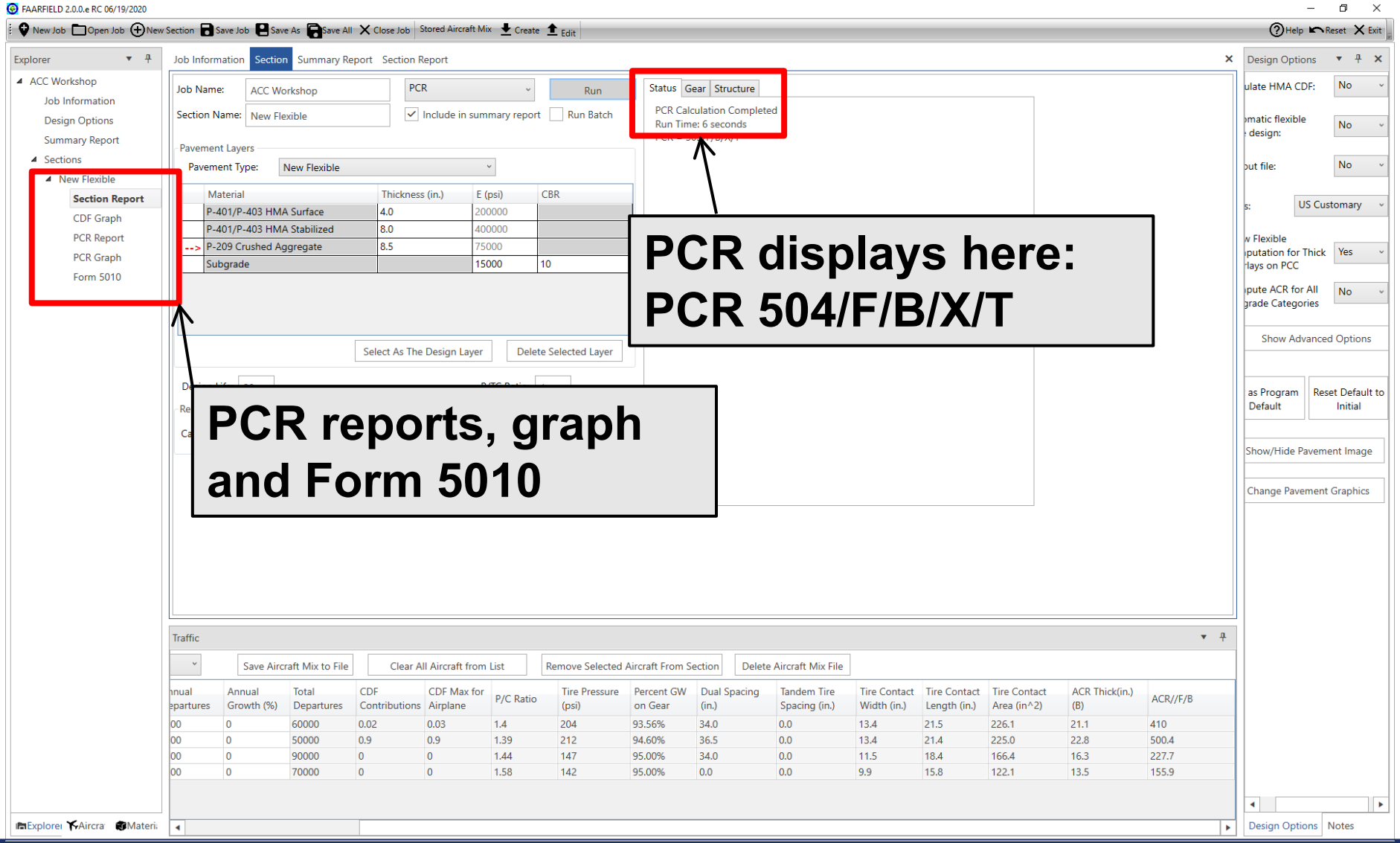
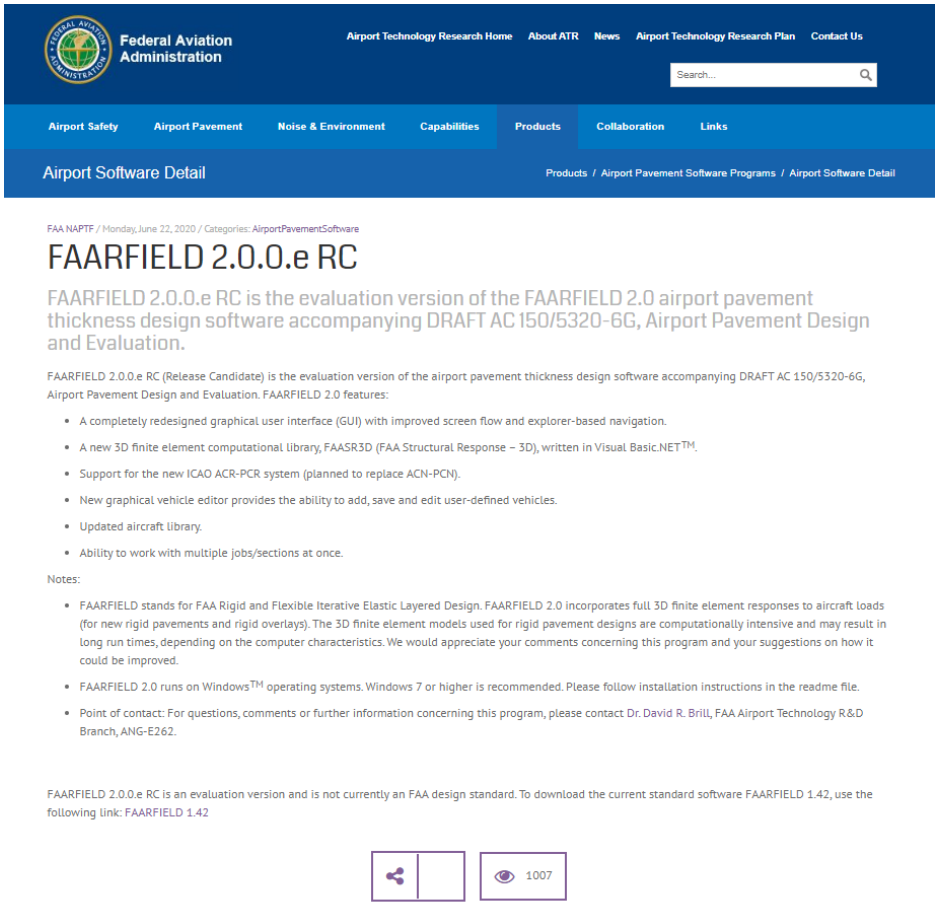


FAARFIELD 2.0 Download

http://www.airporttech.tc.faa.gov/Products/Airport-Pavement-Software-Programs



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FAARFIELD 2.0.0.e RC

FAARFIELD 2.0.0.e RC is the evaluation version of the FAARFIELD 2.0 airport pavement thickness design software accompanying DRAFT AC 150/5320-6G, Airport Pavement Design and Evaluation.

FAARFIELD 2.0.0.e RC (Release Candidate) is the evaluation version of the airport pavement thickness design software accompanying DRAFT AC 150/5320-6G, Airport Pavement Design and Evaluation. FAARFIELD 2.0 features:

- A completely redesigned graphical user interface (GUI) with improved screen flow and explorer-based navigation.
- A new 3D finite element computational library, FAASR3D (FAA Structural Response – 3D), written in Visual Basic.NET™.
- Support for the new ICAO ACR-PCR system (planned to replace ACN-PCN).
- New graphical vehicle editor provides the ability to add, save and edit user-defined vehicles.
- Updated aircraft library.
- Ability to work with multiple jobs/sections at once.

Notes:

- FAARFIELD stands for FAA Rigid and Flexible Iterative Elastic Layered Design. FAARFIELD 2.0 incorporates full 3D finite element responses to aircraft loads (for new rigid pavements and rigid overlays). The 3D finite element models used for rigid pavement designs are computationally intensive and may result in long run times, depending on the computer characteristics. We would appreciate your comments concerning this program and your suggestions on how it could be improved.
- FAARFIELD 2.0 runs on Windows™ operating systems. Windows 7 or higher is recommended. Please follow installation instructions in the readme file.
- Point of contact: For questions, comments or further information concerning this program, please contact Dr. David R. Brill, FAA Airport Technology R&D Branch, ANG-E262.

FAARFIELD 2.0.0.e RC is an evaluation version and is not currently an FAA design standard. To download the current standard software FAARFIELD 1.42, use the following link: FAARFIELD 1.42

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