

User Guide



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Pavement- Transportation Computer Assisted Structural Engineering



US Army Corps of Engineers

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Mr. Peter Wilson, Baltimore District

PCASE Acknowledgements

PCASE History

In the early 1980s, the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) Committee was formed to meet a growing need to automate the pavement design and evaluation process for the Department of Defense (DoD). The committee investigated implementing existing mainframe computer applications on personal computers. The US Army Corps of Engineers (USACE) Waterways Experiment Station—now the Engineering Research and Development Center (ERDC) Geotechnical and Structures Lab—played a leading role in these development efforts in the mid-to-late 1980s.

The first PCASE modules implemented the CBR and Westergaard procedures, followed by layered elastic modeling and analysis in the late 1980s and early 1990s. Many individuals were involved in the research and development efforts that expanded the existing criteria and implemented the evolving criteria in PCASE. Key contributors include: Mr. Don Alexander, Dr. Walter Barker, Dr. Al Bush, Dr. Frans Van Cauwelaert, Dr. Yu T. Chou, Dr. Ray Rollings, and Dr. Jacob Uzan.

In the mid-1990s, PCASE consisted of individual Disk Operating System (DOS) based programs. At this time, Ms. Mary Adolf, USACE Transportation Systems Center, was the PCASE Program Manager. She teamed with Mr. Don Alexander, Dr. Walter Barker, Dr. Carlos Gonzalez, Mr. Robert Walker, Mr. John Lott, and Ms. Lora Johnson to convert the DOS PCASE programs to an integrated Windows application. As part of the Windows update, the team engaged with the PAVER™ Program Manager, Dr. Mo Shahin, ERDC Civil Engineer Research Lab, to integrate PCASE and PAVER™ inventory capabilities. With the help of Dr. Shahin and the PAVER™ development team, they were able to leverage existing PAVER™ inventory tools and complete the Windows update in 2001.

In subsequent years, development team members departed, and new team members were added, including Ms. Lynette Barna, Dr. Alessandra Bianchini, Dr. Jeremy Stache, and Dr. Danniell Rodriguez. Mr. George VanSteenburg took over the PCASE Program Manager role in 2016 when Ms. Adolf retired. The team continued to implement new criteria and maintain and update the PCASE application. In 2015, Intelligent Information Technologies (IIT) joined the development team to support the effort to maintain and update PCASE. The team released multiple updates to the PCASE software until the modernization of PCASE was required. The final release before the modernization of PCASE was PCASE 2.09.08 in May 2021. The objective of the modernization effort was to update the PCASE engineering code, enhance interoperability with PAVER™, and introduce new user interfaces using the Microsoft .NET Framework and Object-Oriented

programming concepts to meet current programming and cybersecurity standards. This effort culminated in the release of PCASE 7.0.1 in October 2021.

PCASE development and modernization continued with Dr. Carlos Gonzalez as the Lead PCASE Engineer until he retired in 2022, when Dr. Jeremy Stache took over as the Lead Engineer. Mr. George VanSteenburg led the program until he retired in 2025, when Mr. Matthew Bennett took over as the PCASE Program Manager. The team produced several versions of PCASE 7, and with this release, the software is written in C# code, utilizes SQLite databases, uses the LEAGL pavement response model, implements ACR/PCR, and features many other modern enhancements.

Past Proponents

The Air Force, Army, Navy, and USACE Districts have been continuous supporters of the PCASE program. Without the support of the Tri-Services, the PCASE program would not be where it is today. We want to thank and recognize the past PCASE proponents.

- HQ USACE
 - Mr. David Bohl
 - Mr. Paul Dicker
 - Mr. Greg Hughes
 - Ms. Jennifer Kline
 - Ms. Mackenzie Searle
- US Army
 - Mr. Michael Andres
- US Air Force
 - Mr. Jim Greene
 - Dr. Barry Mines
- US Navy
 - Mr. Vince Donnally
 - Mr. Greg Cline
 - Mr. Bruce Seamans

Past PCASE Tri-Service Working Group Members

The PCASE Tri-Service Working Group has served as the governance body for the application since the 1990's. The name has changed over time, but its function has been to guide PCASE development by providing feedback, prioritizing requirements, and advocating for funding support. The PCASE TSWG is made up of the Service proponents, the development team, and representatives from USACE Districts and appointees from each Service who are actively engaged in pavement design and evaluation. Their collective efforts of the past TSWG members listed below have ensured PCASE remains current and relevant.

- USACE Districts
 - Mr. Larry Dorsey
 - Mr. Stan Gembicki
 - Mr. Randy Goff
 - Mr. Oz Keifer
 - Mr. Tom Mack
 - Mr. John Rajek
 - Mr. Tom Rossbach
 - Mr. Ron Shafer
 - Mr. Dave Tucker
 - Mr. Ken McNally
- USACE TSC
 - Mr. Kordon Kiel
 - Mr. Danny Klima
 - Mr. Walt Perron
 - Mr. Larry Stringer
 - Mr. John Feider
- ERDC CRREL
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 - Dr. Edel Cortez
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 - Ms. Lynette Barna

- ERDC-GSL
 - Dr. Walter Barker
 - Mr. Don Alexander
 - Dr. Carlos Gonzales
 - Mr. Robert Walker
 - Mr. John Lott
 - Ms. Lora Johnson
 - Dr. Dannel Rodriguez
 - Mr. Andrew Harrison
- US Air Force
 - Mr. Harold Muniz Ruiz
 - Mr. Richard Smith
 - Mr. George VanSteenburg
- US Navy
 - Mr. Vince Donnally
 - Mr. Greg Cline
 - Mr. Bruce Seamans

Dr. Jeremy Stache, and I want to express our heartfelt thanks to the current development team members and the many people who have helped guide us and contributed to the development and success of PCASE over the years. Thank you!

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Table of Contents

1 Introduction to PCASE 7

- 1.1 Scope and Purpose
 - 1.1.1 Scope
 - 1.1.2 Purpose
 - 1.1.3 Module features
 - 1.1.4 Benefits
- 1.2 Downloading and Installing the Software
 - 1.2.1 Recommended Hardware
 - 1.2.2 Upgrading to PCASE 7
 - 1.2.3 32-bit and 64-bit versions of PAVER
 - 1.2.4 Using SQL
 - 1.2.5 Link to the software
 - 1.2.6 Installing the software
- 1.3 Updates to PCASE 7
 - 1.3.1 Improvements to PCASE
 - 1.3.2 Calculation differences

2 File Menu

- 2.1 New/Import
 - 2.1.1 New/Import pavement database
 - 2.1.2 GIS/Tabular Import
- 2.2 Open pavement database
- 2.3 Event Manager
 - 2.3.1 Manage Event Folders
 - 2.3.2 Assign Events
- 2.4 Take Pictures
- 2.5 GIS Manager
- 2.6 GIS Recycle Bin
- 2.7 GIS/Tabular Import and Update
 - 2.7.1 Add Inventory from GIS/Tabular Data
 - 2.7.2 Update Inventory from GIS/Tabular Data
 - 2.7.3 Import Inventory Samples from GIS/Tabular Data
- 2.8 Export Open Pavement Database
- 2.9 Combine Inventories
- 2.10 Database Properties
- 2.11 Delete Pavement Database
- 2.12 Database Recycle Bin
- 2.13 Combine or Import PCASE 209 Data
- 2.14 PCASE Data Assignment
- 2.15 PCASE Database Verification Tool
- 2.16 Exit

3 System Tables and Tools

- 3.1 User Defined Inventory Fields
 - 3.1.1 New/Existing Fields
 - 3.1.2 Delete Fields (Recycle Bin)
- 3.2 Edit Inventory Picklists
 - 3.2.1 Engineering Fields
 - 3.2.2 Descriptive Fields
- 3.3 Condition Tools
 - 3.3.1 Select Condition Types
 - 3.3.2 Define Condition and Age Categories
- 3.4 Vehicles
 - 3.4.1 Vehicle Editor
 - 3.4.2 ACN/ACR Charts
 - 3.4.3 Import User Defined Vehicles
 - 3.4.4 Update Standard Vehicles

4 User Preferences

- 4.1 English Units
- 4.2 Metric Units
- 4.3 EMS Desktop
- 4.4 Windows Desktop
- 4.5 Language
- 4.6 Defaults
 - 4.6.1 Overview
 - 4.6.2 GIS Settings
 - 4.6.3 Inventory
 - 4.6.4 Inspection
 - 4.6.5 Verification Tools
 - 4.6.6 Menus
 - 4.6.7 Graph Defaults
 - 4.6.8 PCASE Defaults
- 4.7 GPS Device

5 Window

- 5.1 Tile Horizontally
- 5.2 Tile Vertically
- 5.3 Cascade
- 5.4 Arrange Icons

6 Help

- 6.1 Program Version
 - 6.1.1 Move User Data Folder
 - 6.1.2 Open Error Log
- 6.2 Getting Started with PCASE 7
- 6.3 PCASE 7 User Guide

7 Inventory

- 7.1 Define Inventory
 - 7.1.1 Network
 - 7.1.2 Branch
 - 7.1.3 Section
 - 7.1.4 Condition/Families
 - 7.1.5 Samples
- 7.2 GIS Assignment
- 7.3 Asset Management
 - 7.3.1 Import/Assign Asset Items using GIS/Tabular Import
 - 7.3.2 View/Edit Asset Identities
 - 7.3.3 Assign/Unassign Asset Items
- 7.4 Centralized Asset Management
 - 7.4.1 Create Asset File for Distribution
 - 7.4.2 Import Asset File
- 7.5 Copy and Move Data

8 Reports

- 8.1 GIS Reports
- 8.2 Summary Charts
- 8.3 Enterprise Summary Reports
- 8.4 Standard Reports
- 8.5 User Defined Reports

9 Selectors

- 9.1 GIS Selector
- 9.2 GIS/Tree Selector
- 9.3 List Selector
- 9.4 Asset List Selector
- 9.5 Tree Selector
- 9.6 Tree Date Selector
- 9.7 Search Selector

10 Work

- 10.1 Work History
- 10.2 Add Work History from GIS/Tabular Data

11 Design Module

- 11.1 Getting started
- 11.2 Project Properties
- 11.3 Design Properties
- 11.4 Layer Properties
- 11.5 Design examples
 - 11.5.1 Flexible surfaced road using a new traffic pattern
 - 11.5.2 Unsurfaced tank trail using a new traffic pattern
 - 11.5.3 Mat surfaced airfield using a new traffic pattern
 - 11.5.4 Flexible surfaced airfield using standard traffic in a frost area

- 11.5.5 Rigid surfaced parking area using standard traffic in a frost area
- 11.5.6 Overlays for an existing rigid airfield pavement
- 11.5.7 Airfield shoulder pavement
- 11.5.8 Flexible surfaced airfield using Layered Elastic Design; one season
- 11.5.9 Rigid surfaced parking area using Layered Elastic Design; multiple seasons

12 Evaluation checklist

- 12.1 Getting Started
- 12.2 Show inventory form
- 12.3 Evaluation Manager
 - 12.3.1 Evaluation
 - 12.3.2 Climate
 - 12.3.3 Default evaluation settings
 - 12.3.4 Default APE settings
 - 12.3.5 Default LEEP settings
- 12.4 Evaluation checklist

13 LEEP evaluation

- 13.1 Getting Started
- 13.2 LEEP Evaluation Form
 - 13.2.1 Evaluation Manager
 - 13.2.2 Layer Model
 - 13.2.3 Traffic tab
 - 13.2.4 Section tab
 - 13.2.5 Settings
 - 13.2.6 Layers
 - 13.2.7 Results
- 13.3 LEEP Examples
 - 13.3.1 Evaluate pavements by manually inputting modulus values
 - 13.3.2 Evaluate pavements using DCP results
 - 13.3.3 Evaluate pavements using backcalculated modulus values

14 APE evaluation

- 14.1 Getting Started
- 14.2 APE Evaluation form
 - 14.2.1 Evaluation Manager
 - 14.2.2 Layer Model
 - 14.2.3 Traffic tab
 - 14.2.4 Section tab
 - 14.2.5 Settings
 - 14.2.6 Layers
 - 14.2.7 Results
- 14.3 APE Examples
 - 14.3.1 Evaluate pavements by manually inputting layer strength values

15 FWD data

- 15.1 Getting Started
- 15.2 FWD data form
 - 15.2.1 Evaluation Manager
 - 15.2.2 Import, Enter and Assign FWD/HWD Files to Section Inventory
 - 15.2.3 Interacting with the FWD/HWD Chart
 - 15.2.4 Selecting FWD/HWD Data Points and Viewing Representative Basin
 - 15.2.5 Assigning Selected FWD/HWD Data Points to Section Inventory
 - 15.2.6 Viewing Assigned FWD/HWD Data Points in LEEP
- 15.3 FWD Data Example
 - 15.3.1 Perform Analysis of Pavement Using Deflection Basin Data

16 DCP data

- 16.1 Getting Started
- 16.2 DCP Data form
 - 16.2.1 Evaluation Manager
 - 16.2.2 DCP Tests
 - 16.2.3 Layer models
 - 16.2.4 Graph of tests and layer models
- 16.3 DCP Examples
 - 16.3.1 Importing a DCP File and Layer Model Creation
 - 16.3.2 Manual Data Entry of DCP Data and Performing APE Analysis

17 PCASE Reports

- 17.1 Evaluation Checklist
- 17.2 Evaluation Results (ACN-PCN) or (ACR-PCR)
- 17.3 Mixed Traffic AGL-PCN Report
- 17.4 Army AGL-PCR Report
- 17.5 ISR Report (ACN-PCN) or (ACR-PCR)
- 17.6 14-Group AGL Report
- 17.7 14-Group PCN Report
- 17.8 Section PCR Report
- 17.9 Hybrid Traffic
- 17.10 Backcalculation Results
- 17.11 Modulus Tables
- 17.12 Representative Basins
- 17.13 ISM Report – All Stations
- 17.14 ISM Report – Images
- 17.15 ISM Report – Excel
- 17.16 DCP Data
- 17.17 Contingency PCI Report
- 17.18 CAPE PCI Summary Table
- 17.19 CAPE Allowable Passes Table (PCN) or (PCR)

18 Contingency PCI

18.1 Getting Started

18.2 PCI Calculator

18.2.1 Sample and Distress Data

1 Introduction to PCASE 7

1.1 Scope and Purpose

1.1.1 Scope

PCASE 7 software implements US Department of Defense criteria for the design and evaluation of airfield, roadway, and parking pavements. If the design or evaluation is considered controlled unclassified information, the user shall ensure the user data directory is set to a file location on the computer that is only accessible by the person creating the database. Further details are available in Step 6 of [1.2.6 Installing the Software](#).

1.1.2 Purpose

PCASE 7 automates the pavement design and evaluation procedures outlined in the Unified Facility Criteria (UFC).

Design determines the thickness required for pavements in non-frost and frost areas.

Evaluation determines the load-carrying capacity of pavements (used or to be used). An evaluation is conducted to assess the allowable traffic that a pavement can sustain for given loading conditions or the allowable load for a given amount of traffic without producing distress.

US Department of Defense criteria used for the development of PCASE	
Unified Facility Criteria	Description
UFC 3-201-01	Civil Engineering
UFC 3-250-01	Pavement Design for Roads, Streets, Walks, and Open Storage Areas
UFC 3-250-09	Aggregate Surfaced Roads and Airfields Areas
UFC 3-260-01	Airfield and Heliport Planning and Design
UFC 3-260-02	Pavement Design for Airfields
UFC 3-260-03	Airfield Pavement Evaluation

1.1.3 Module Features

PCASE 7 includes the capability to perform pavement designs and evaluations, analyze Falling Weight Deflectometer (FWD) and Dynamic Cone Penetrometer (DCP) data, and track physical property data. The PCASE tools include:

Design Module - capable of designing roadway and airfield flexible, rigid, mat (airfield only) and aggregate pavement using the following models:

- Layered Elastic for flexible and rigid pavements
- California Bearing Ratio (CBR) Stress-Based (CBR-Beta) for flexible pavements
- Westergaard Plate Solution (k) for rigid pavements
- CBR-Alpha for aggregate and mat surfaced pavements

The Design Module is also capable of calculating the required subsurface drainage layer thickness, overlays, airfield shoulders, and account for seasonal variations.

Evaluation Checklist - displays sections in an Evaluation and the APE and LEEP status. Sections can be added, edited and deleted.

LEEP evaluation - capable of analyzing pavements using the layered elastic method producing resultant allowable loads, passes, Pavement Classification Numbers (PCN), Pavement Classification Rating (PCR), and overlay requirements.

APE evaluation - capable of analyzing pavements using the empirical method producing resultant allowable loads, passes, Pavement Classification Numbers (PCN), Pavement Classification Rating (PCR), and overlay requirements.

FWD data - capable of importing and viewing falling weight deflectometer (FWD) data, defining section boundaries, and assigning data for backcalculation.

DCP data - capable of analyzing field Dynamic Cone Penetrometer (DCP) data and providing resultant pavement layer strengths.

Contingency PCI - capable of quantifying PCI based on pavement distress data and transposing calculated PCI to APE or LEEP evaluation for use in analyses.

1.1.4 Benefits

PCASE provides the ability to perform pavement thickness designs quickly and thereby providing the ability to make decisions faster and with precision and consistency. PCASE is also used for determining pavement life. The analysis information obtained from the software (allowable passes, loads, pavement classification numbers, etc.) is critical to engineers, pilots, and airfield administrators.

1.2 Downloading and Installing the Software

1.2.1 Recommended Hardware

Memory: 2 GB RAM for 32-bit desktop

4 GB RAM for 64-bit desktop for small to medium databases

8 GB RAM for 64-bit desktop for large databases (10,000+ sections)

The PCASE 7 user interface is designed for use on modern desktop and laptop screens. A minimum screen resolution of 1920 x 1080 pixels is recommended. At that resolution, a screen scale of no more than 150% is recommended.

1.2.2 Upgrading to PCASE 7

PCASE 7.0 and the PAVER™ pavement management application can share the same database which is particularly useful for pavement evaluation since both pavement condition surveys, and structural evaluations use the same inventory data. PCASE 7.0 supports the import of PAVER™ *.e60, *.e65, and *.e70 files. Users should export their file(s) to one of these formats, and then, import the file(s) into PCASE 7 using the File Menu: New/Import >> New/Import pavement database.

To import a PAVER™ 5.x database users must import the *.e5x file to PAVER™ 6 and then export an *.e60 or *.e65 file. PCASE 7.0 **does not** support the import of PAVER™ *.e5x files.

1.2.3 32-bit and 64-bit Versions of PAVER™

PCASE 7.0 can be installed on 32-bit or 64-bit Windows computers. On a 64-bit computer, desktop icons for both versions will be put on the desktop during the install.

With the 32-bit version of PCASE 7.0; the user can use Microsoft Access, SQL, SQL Local DB, or SQLite databases. Local DB will be installed with PCASE, but if the user chooses to use SQL databases, then the computer must be able to access an instance of SQL (Express, Server, etc.).

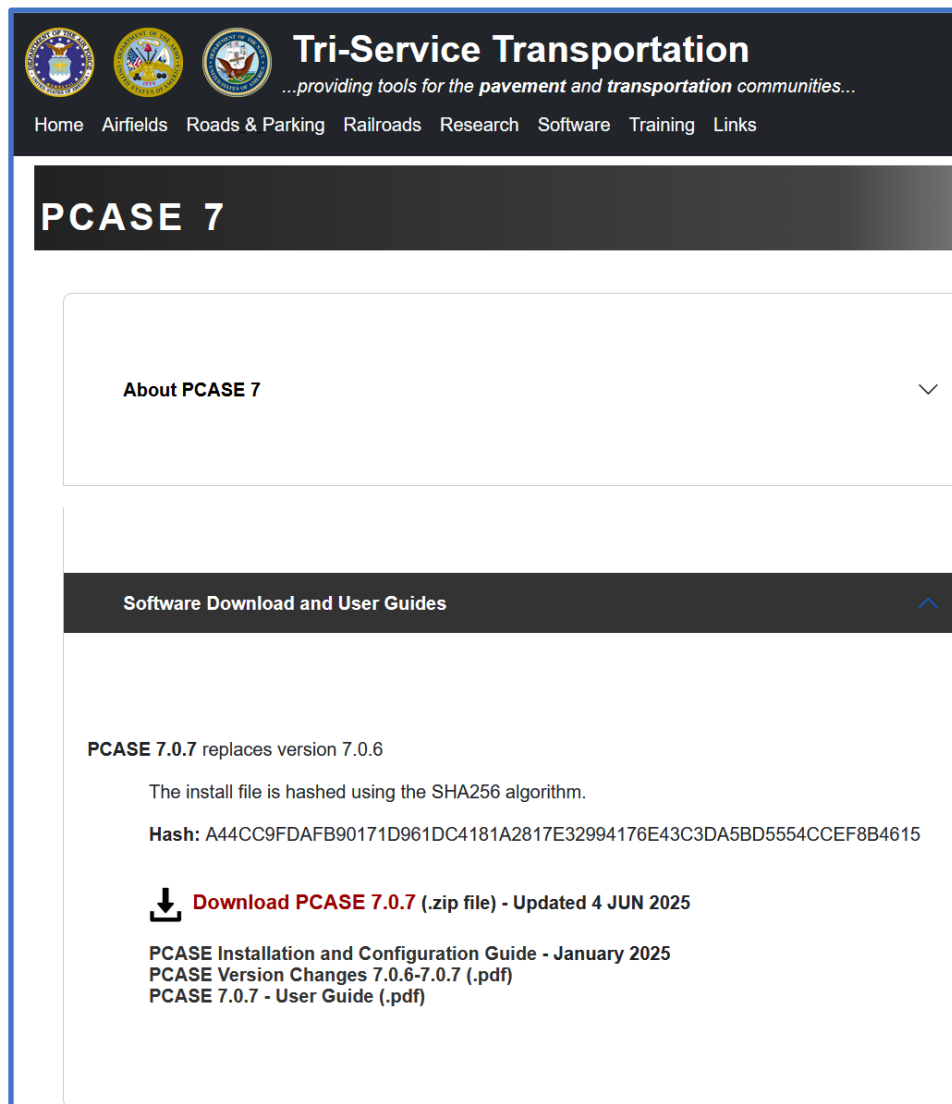
The 64-bit version of PCASE 7.0 uses SQL databases (in which an instance of SQL must be available for use by the PAVER™ inventories) and SQLite databases. SQLite is a local, file-based database for single users.

1.2.4 Using SQL

SQL Server/Express 2012 or later is required. Inventories in SQL are stored in SQL's data directory, not in the user data folder. Prior to upgrading SQL, users should backup databases to E70 in order to prevent data loss during the upgrade process.

1.2.5 Link to the software

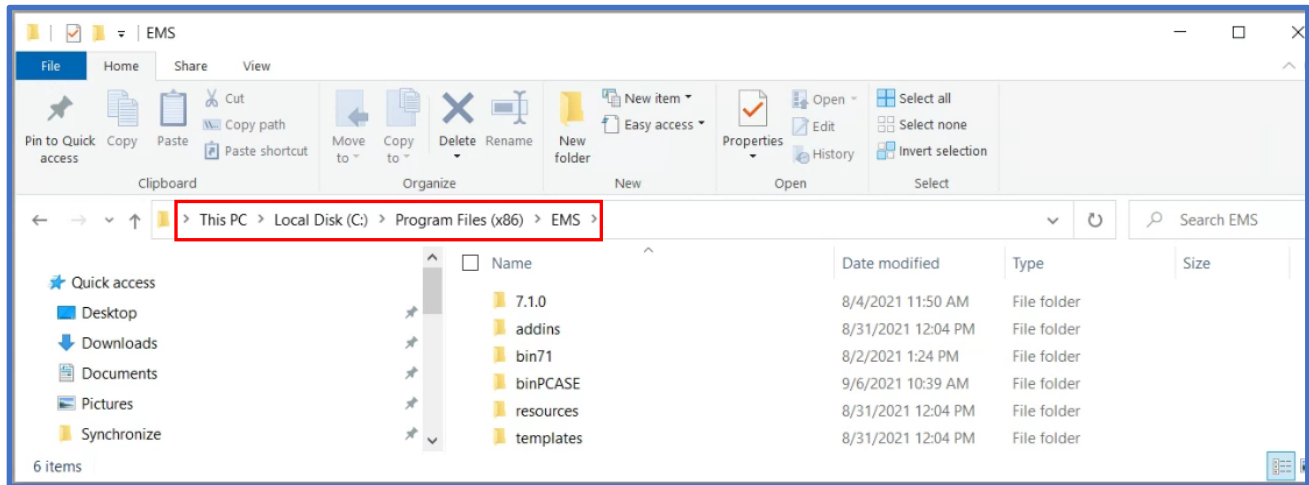
To download the PCASE software, go to the PCASE website at www.pcase.com or <https://transportation.erdc.dren.mil/pcase/>. Click on “Software Download and User Guides”.



1.2.6 Installing the software

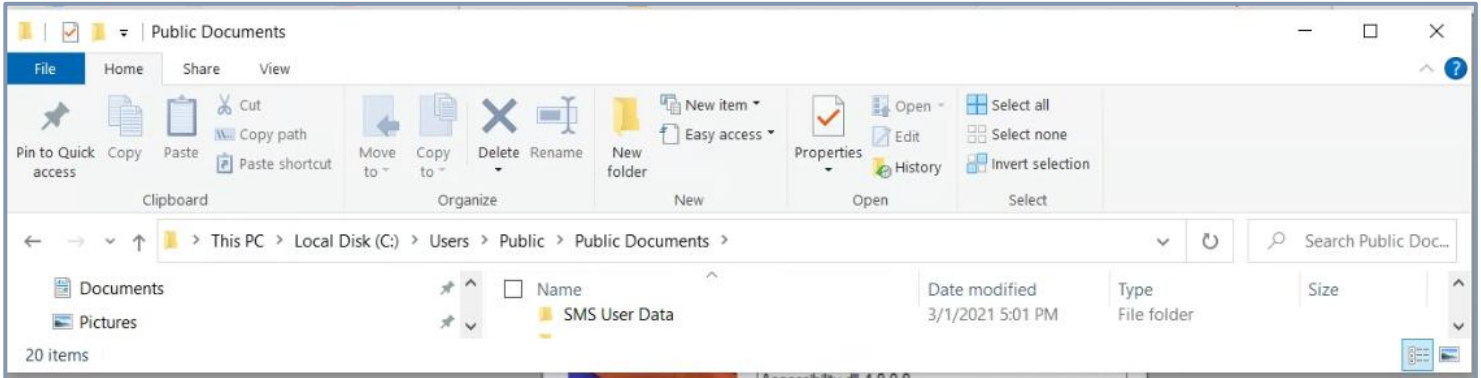
1. Download, then open the zip File and extract the PCASE 7.0.x Setup.exe file. As a cybersecurity measure, the administrator has the option of running a hash algorithm on the setup.exe before beginning the install. The zip file contains a .txt file with the algorithm, SHA256 and the hash code. This information is also posted on the download site above as a check.
2. Installation requires administrator privileges, and it is assumed PCASE is being installed on a NIPR system.

3. Program Default Install: The PCASE application installs to C:\Program Files (x86)\EMS folder. We recommend the default install location. If there is a need to change the install location, contact the PCASE Program Manager, Matthew Bennett (matthew.d.bennett@usace.army.mil). Note that PCASE provides an option to install SQL Local DB which is a single user stripped down version of SQL Server Express.



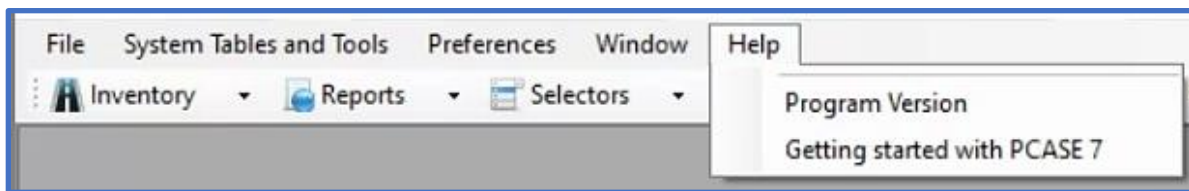
Local DB is required when a user wants to operate PCASE in 64-bit mode.

4. Silent Install: Use the options below when doing a silent install.
 - a. Use flags /qn and /quiet to install silently.
 - b. If this does not work, use /exenoui /qn. Note that the installer also needs elevated privileges for this option.
5. Default Data Folder: If you are prompted to define the user data folder locations, we recommend the default user data folder location C:\Users\Public\Documents\SMS User Data.
 - a. If the user data folder is set to a location that's not writable by all users, other users will not be able to access the data if the computer is given to another individual or the computer is shared.
 - b. The user data folder is where the user preferences, data, and maps are stored. Thus, any user will need read/write privileges for the directory to access the data and the assumption is that a database created in this folder is publicly releasable unclassified information.
 - c. PCASE uses a configuration file to remember the user's specified 'User data folder'. It is located at **C:\ProgramData\iitcorp\WGServerConfig.xml.cy** (Note: C:/ProgramData is the operating system's recommended location to store application configuration that should apply to all user accounts on a computer.)

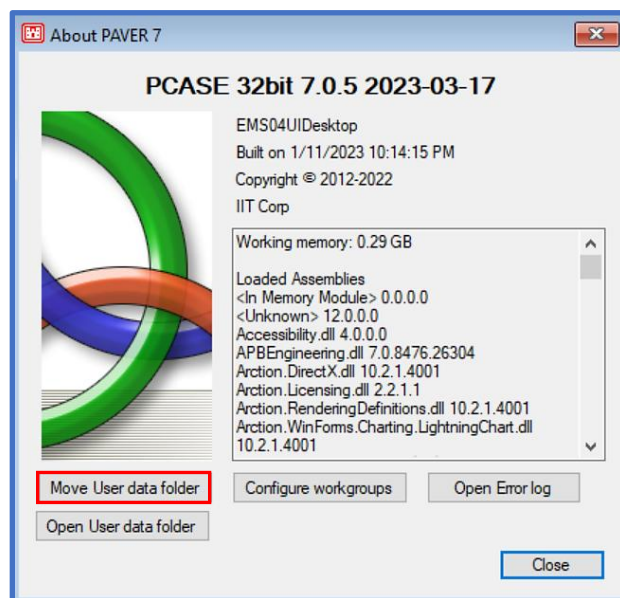


6. **Controlled Unclassified Information (CUI):** If the data in a database is considered CUI, change the data directory to a location only the user and administrator have read/write permissions and is not publicly accessible. The process for making this change is outlined below. It is the host system's responsibility to ensure that successful and unsuccessful attempts to access the information are audited and that the CUI is protected appropriately.

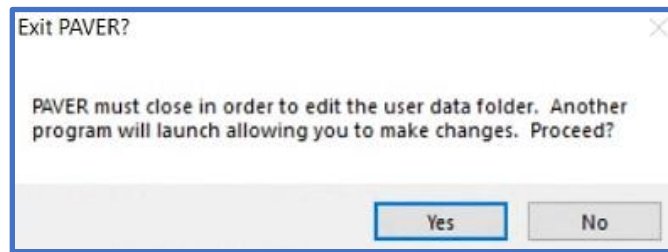
- a. In PCASE, go to Help>>Program Version



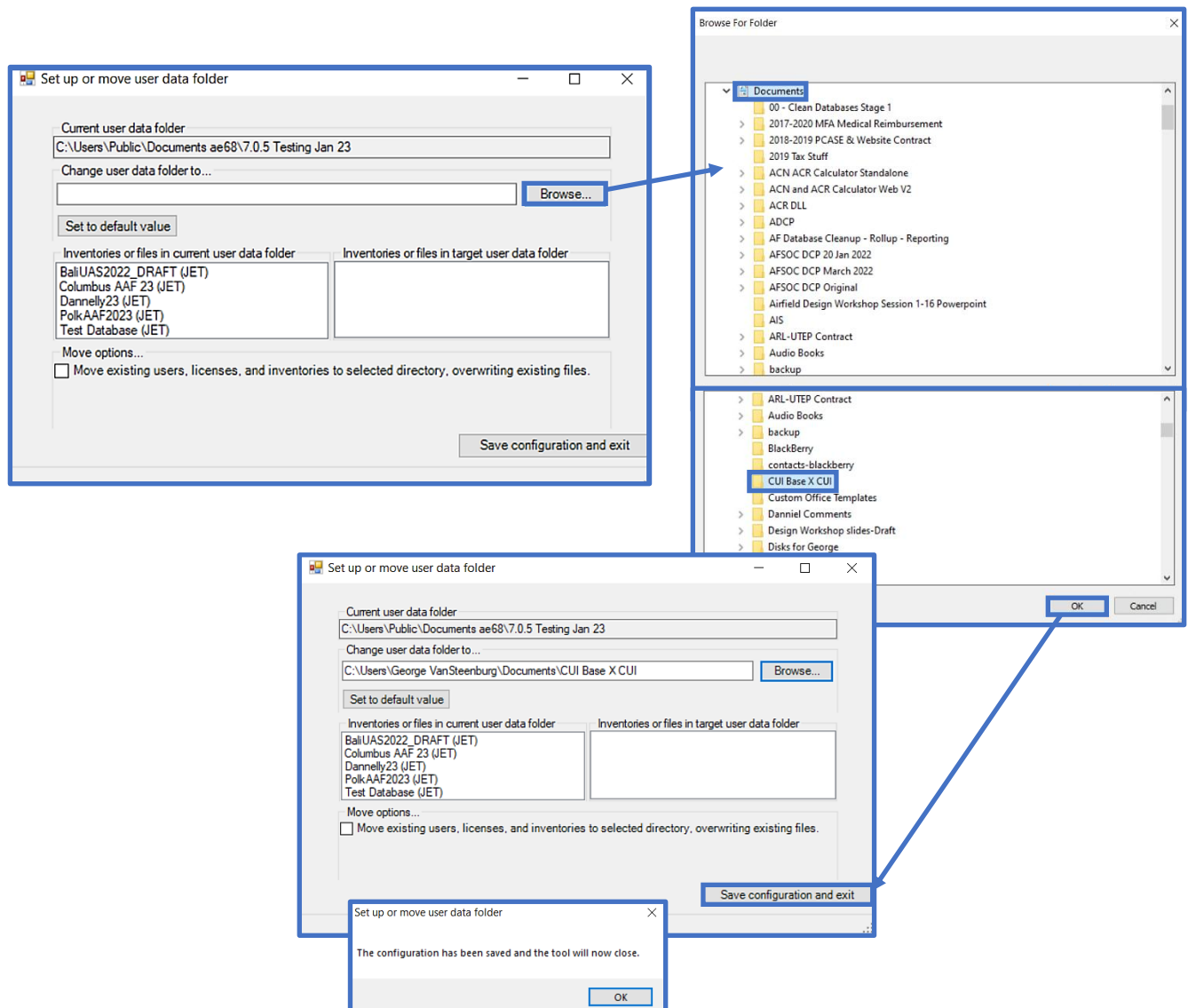
- b. Select Move User Data Folder



c. Select Yes

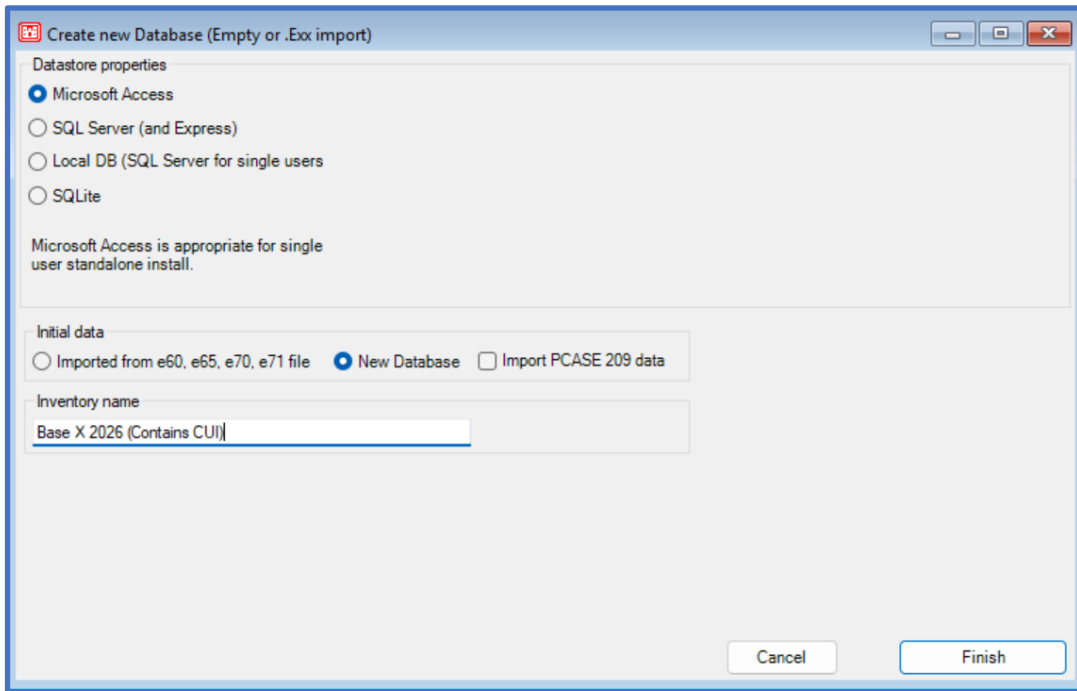


d. **Browse to a location with read/write permissions accessible to the user e.g., C://Users/user name/documents and create an SMS folder there.**



e. Select Ok (screen shot above), select Save Configuration and exit, select Ok.

7. Open PCASE and create a database following guidance within [Chapter 2.1.1 New/Import](#). The recommended best practice is to include the classification level in the name of the file and whenever exporting a database.



8. Report Generation: PCASE reports use excel templates without any classification markings based on the assumption that all data is unclassified, publicly releasable. If the information in the individual database is CUI, it is the user's responsibility to properly mark any reports generated by PCASE at the appropriate classification level. The user will add a header and footer with the appropriate classification markings.

1.3 Updates to PCASE 7

1.3.1 Improvements to PCASE

- A single database can contain multiple evaluations and design projects.
- In addition to Microsoft Access, there are two new database management system options; Local DB and SQL Server.
- PCASE 7 is multi-user capable.
- File format has changed from PCASE Zip files (.EMSZ) to .e70.
- User-edited vehicles travel with the database.
- Separate APE and LEEP forms that can be open simultaneously for easy comparisons.
- Unified Design form with less steps.
- Separate traffic forms for designs and evaluations. Traffic is defined within each module as part of the workflow.
- Less repetition of data entry; default values now auto-populate and range checking messages have been implemented to display the correct value ranges for specific criteria.
- Forms have customization options; panels can be resized and collapsed, layer model grid layouts can be revised and saved, APE and LEEP form layouts can be saved.
- Multiple options for combining different types of data.
- Added PCASE Data Assignment tool to allow moving inventory data within a database.
- Added ACN/ACR Charts.
- Preference options for criteria and default moduli settings.
- Addition of Controlling Traffic Mode options in APE and LEEP.
- Added Mission Critical Aircraft for ACN functionality.
- Updated precipitation and weather databases.
- Changed terminology for Slip to Bond and enabled modifying the Bond values for each layer.
- Added ability to create Ad Hoc sections in APE and LEEP.
- Made optimizations to DCP.

1.3.2 Calculation differences between PCASE 7.0.7 and 7.0.8

LEAGL – Layered Elastic Module

To improve the accuracy of near surface pavement responses, additional integration intervals were added as well as tightening the minimum error required to jump out of the numerical integration loop when evaluating the solution integrals. This change may produce some differences for those cases where the asphalt strain criterion controlled during the calculation of allowable gross loads and passes.

Parallelism

To improve the speed of calculations, several routines were updated with parallel loops.

Unsurfaced Frost Calculation

In PCASE 7.0.7, the Unsurfaced layer type was not properly incorporated in the calculation of the combine. This is now fixed.

Mats Calculations

Added modified AGL predictor to the Mats analysis to overcome some cases where the empirical nature of this analysis leads to unstable solutions.

APE and LEEP AGL not meeting criteria

Made several corrections in APE and LEEP to trap those cases where the limiting criteria could not be met when calculating AGLs. Those cases are now flagged to be properly reported on the GUI.

Layered Elastic Design of Reinforced PCC pavements

Corrected issue where the incorrect unreinforced design thickness was used to enter in the reinforced PCC thickness nomograph.

Frost Calculations, Design and APE

The determination of the frost depths required the calculation of a parameter called lamda, which was previously unbounded. This fact sometimes produced incorrect frost depths. Now lamda is limited to a lower value equal to 0.3. Also, the controlling layer during frost in APE analysis is now properly selected.

Design of AC/PCC pavements

Depending on the input, the empirical AC/PCC overlay equation may produce an equivalent PCC thickness (h_e) greater than the sum of the existing Ac (T_o) and PCC thicknesses (T_x) ($h_e > T_o + T_x$). This was changed to limit $h_e = T_o + T_x$.

Reporting PCN and PCR for AC/PCC pavements

The PCN and PCR string code now treats AC/PCC composite pavements as rigid pavements and sets the pavement type to code “R”.

Equivalent Single Axle Loads (ESAL) Calculations

ESALs are now calculated using the AASHTO standard equivalent axle load factors equations for a terminal serviceability, $p_t=2.0$. Also added ESAL calculations to layered elastic design.

Effective-k calculation in the presence of geotextiles

Correct bug in APE and Design dealing with the calculation of effective-k for pavements containing geotextiles as separation layers.

Different results for coverages <10 for unsurfaced pavements, Design and APE

There was a bug that impacted unsurfaced design and evaluation cases for coverages less than 10, which resulted in differences despite matching pavement structure and traffic levels. The pass-to-coverage ratio is a statistical parameter to account for lateral wander and was only really applicable for a significant number of pass levels. This has been corrected by making an adjustment to the pass-to-coverage ratio for coverages less than 10. An issue in unsurfaced dealing with the calculation of ESWL where the tire pressure was changed during iterations of AGL was also corrected; we always assume constant contact pressure.

APE test case failures due to changes in AGL and APS calculation for CBRs between 20 and 30

The current DOD pavement design and evaluation procedure is based on a CBR-Beta-Alpha Hybrid procedure that uses CBR-Beta criterion for CBR ≤ 20 and the CBR-Alpha criterion for CBR ≥ 30. An interpolation method is recommended to manually determine the allowable gross load or allowable passes for intermediate CBR values. For instance, to determine the allowable load for a CBR = 23, first determine the AGL for CBR = 20 (AGL₂₀) and CBR = 30 (AGL₃₀). Then use linear interpolation to determine the AGL at CBR = 23 (AGL₂₃) as shown by Equation 14.

$$AGL_{23} = AGL_{20} + \left(\frac{AGL_{30} - AGL_{20}}{CBR_{30} - CBR_{20}} \right) (CBR_{23} - CBR_{20})$$

The more precise computerized solution generated from PCASE will differ from the manual solution for CBR values between 20 and 30.

Test cases 20 and 138 failed due to the changes made. In those cases, the controlling layer happens to have a CBR=25, which caused the change in results.

Test Case Case 020													
	Overall Pass/Fail	Input ACN	Result ACN	Input PCN	Result PCN	Input Allowable Load	Result Allowable Load	Input Allowable Passes	Result Allowable Passes	Input Overlay Req. AC	Result Overlay Req. AC		
	Fail	40	41	29/F/A/W/T	30/F/A/W/T	443	448.5	3419	5061	1.8	0.9		
Test Case Case 138													
	Overall Pass/Fail	Allowable Load	Allowable Load	Allowable Load Frost	Allowable Load Frost	Input Allowable Passes	Allowable Passes	Input Allowable Passes Frost	Result Allowable Passes Frost	Input Overlay Req. AC	Result Overlay Req. AC	Input Overlay Req. AC Frost	Result Overlay Req. AC Frost
	Fail	27	33.7	25.6	25.6	99999999	99999999	99999999	99999999	0	0	0	0

Airbus A380-800

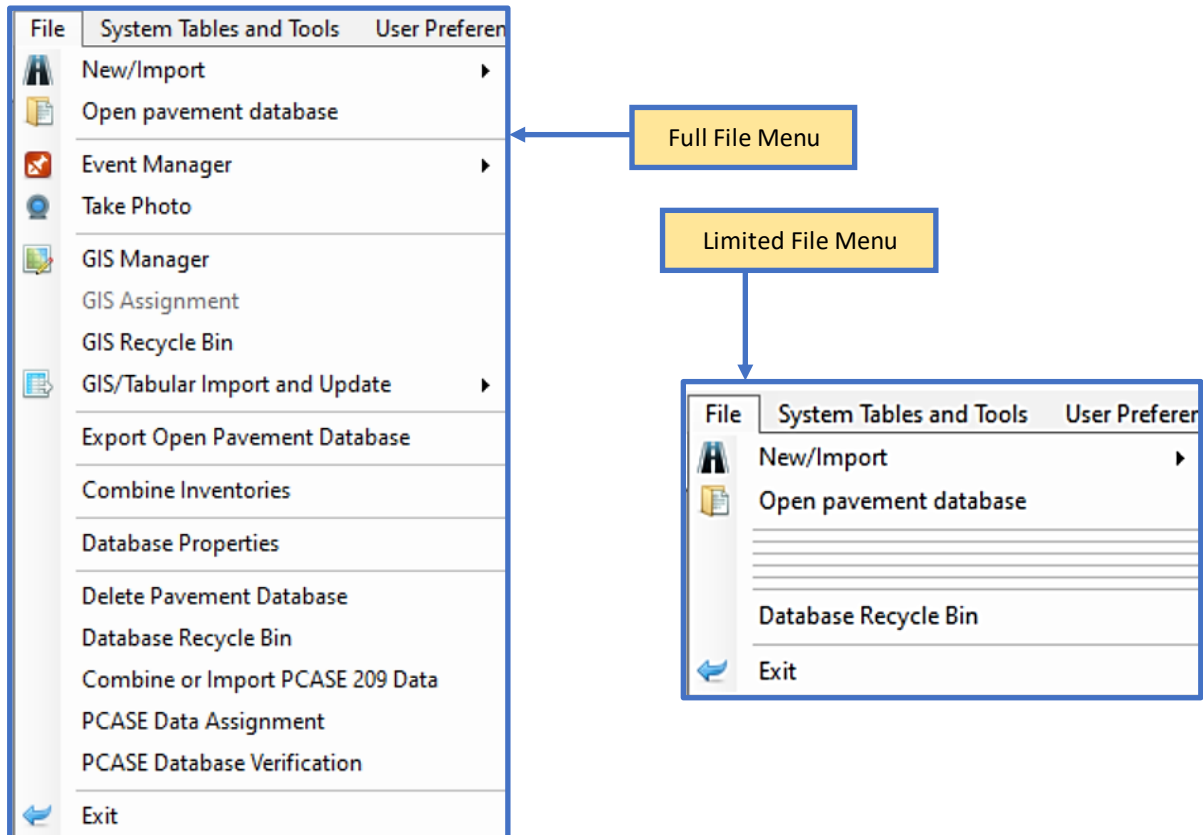
For efficiency reasons, we pre-calculate ACN and ACR values for each standard aircraft. We do this at 50 load levels for each aircraft, from 0.5 minimum weight up to 10x max weight. This produces 8 curves for each aircraft (flexible/rigid x subgrade categories A, B, C, D). In PCASE, when an ACR or ACN value is needed, we just interpolate the pre-calculated curves, which is optimally fast. To pre-calculate ACR values, we use the FAA's ACR DLL. On one specific, very heavy aircraft (the Airbus A380-800) the library indicated problems at some of the very high gross loads, and produced ACRs that were probably less than they should be (based on values for nearby weights). This only happened at very high gross loads, greater than 7x the vehicle's max weight. Since this is much larger than any weight PCASE will use or display, we do not expect the results will ever be visible to users.

Added a check for moduli oscillations in LEEP backcalculation

Added code to check on moduli oscillations between iterations. The new logic tests for moduli oscillations within a window of three iterations. If the average values of two consecutive iterations are within 14; it considers the moduli to be oscillating around a common value. If so, the predicted moduli are set to the average values of the current iteration, then applied to layers. Improved oscillation routine using parallelization to optimize calculation speed.

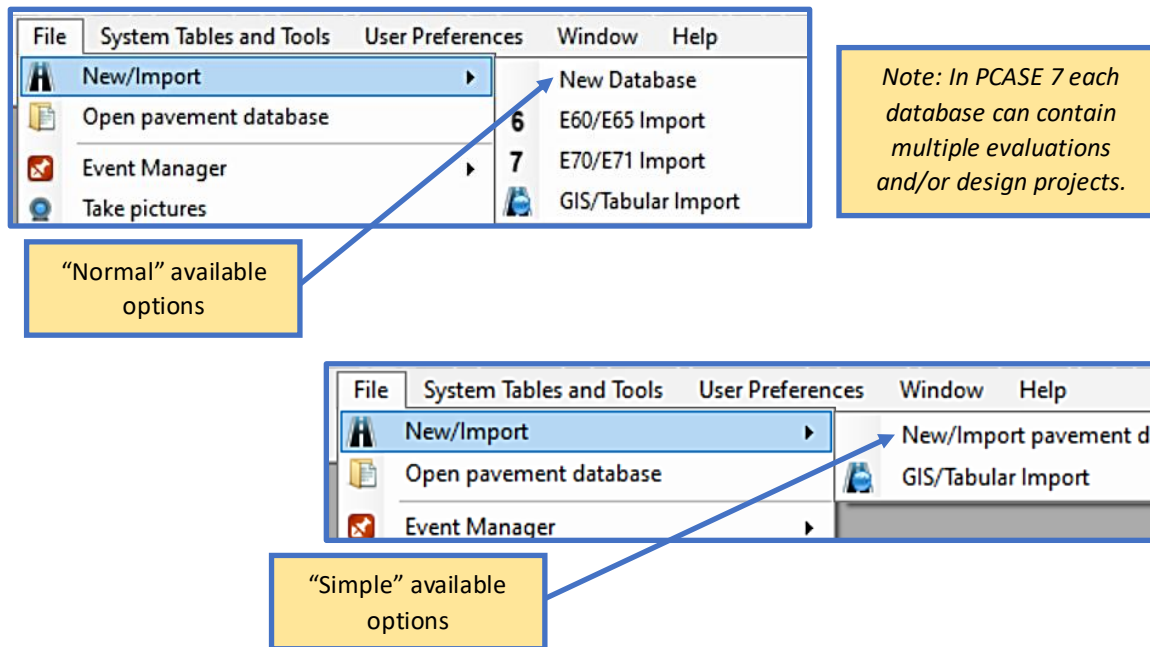
2 File Menu

The **File** menu consists of options that pertain to handling user data or databases. A database must be open for all of the below options to be displayed. If PCASE 7 detects that a database has not been opened, only the limited options will be visible.



2.1 New/Import

The first time you use PCASE 7, you will need to create or open a database before you can use the program. Use the **New/Import** options to create or import a database. The options that are displayed within the **New/Import** list are dependent upon the **Normal** or **Simple** preference option that can be selected in **User Preferences > Defaults > Menus**. The **Normal** vs. **Simple** option also affects the format of the **Create New Pavement Database** form. We recommend that PCASE 7 users default to **Simple**. Changes made in the **Menus** tab require a program restart to take effect.



2.1.1 New/Import pavement database

Create a new PCASE 7 database or import an existing E60, E65, E70 or E71 database by selecting the **New/Import > New/Import pavement database** option. *Note: Microsoft Access databases, Local DB databases, and 32-bit PCASE are being deprecated. In PCASE 7.0.8, designers should start to use SQLite databases and 64-bit. The evaluation teams that use PCASE and PAVER™ should wait until PAVER™ 7.2 is released to use SQLite databases, so that there are not compatibility issues between PAVER™ and PCASE.* Once the **Create New Database** form opens:

1. Choose a **Datastore properties** option: **Microsoft Access** is currently the recommended default option suitable for most single user, standalone installs. **Local DB** and **SQL Server** are both options for SQL Server users; these options support larger databases and **SQL Server** supports multiple users.
2. Choose from one of the three radio button options within the **Initial Data** group:
 - **Imported from e60, e65, e70, e71 file** enables the import of a database with an .exx file extension; use this option if you have existing PAVER™ or PCASE 7.0 data. Select the **Browse to File** button to locate the file using File Explorer. Once the file has been selected, the file path will populate in the form's **Inventory import file** field. Only check the **System tables created from defaults and appended with source data** checkbox, if applicable.
 - Use the **Inventory Name** that populates automatically (if an .exx file was provided) or give the database a new name (most often the name of the location/installation).

- The **New Database** option will create a blank/empty database. Once the radio button has been selected, name the new database using the **Inventory name** field, then select **Finish**.
 - The **Import PCASE 209 data** option can be used to import a PCASE 2.09 database into an existing .e70, or a new PCASE 7.0 database. The **Import PCASE 209 database** form will open once the database has been created.
3. The **Finish** button enables once the required fields have been satisfied; select **Finish** to create the database.
 4. If you selected **Import PCASE 209 data**, another form will open once the database has been created. Continue with the following steps to complete the import process.

Create new Database (Empty or .Exx import)

1 Datastore properties

☒ Microsoft Access

☐ SQL Server (and Express)

☐ Local DB (SQL Server for single users)

☐ SQLite

Microsoft Access is appropriate for single user standalone install.

2 Initial data

☒ Imported from e60, e65, e70, e71 file ☐ New Database ☐ **4** Import PCASE 209 data

Inventory import file (e60, e65, e70, e71)

Browse to file

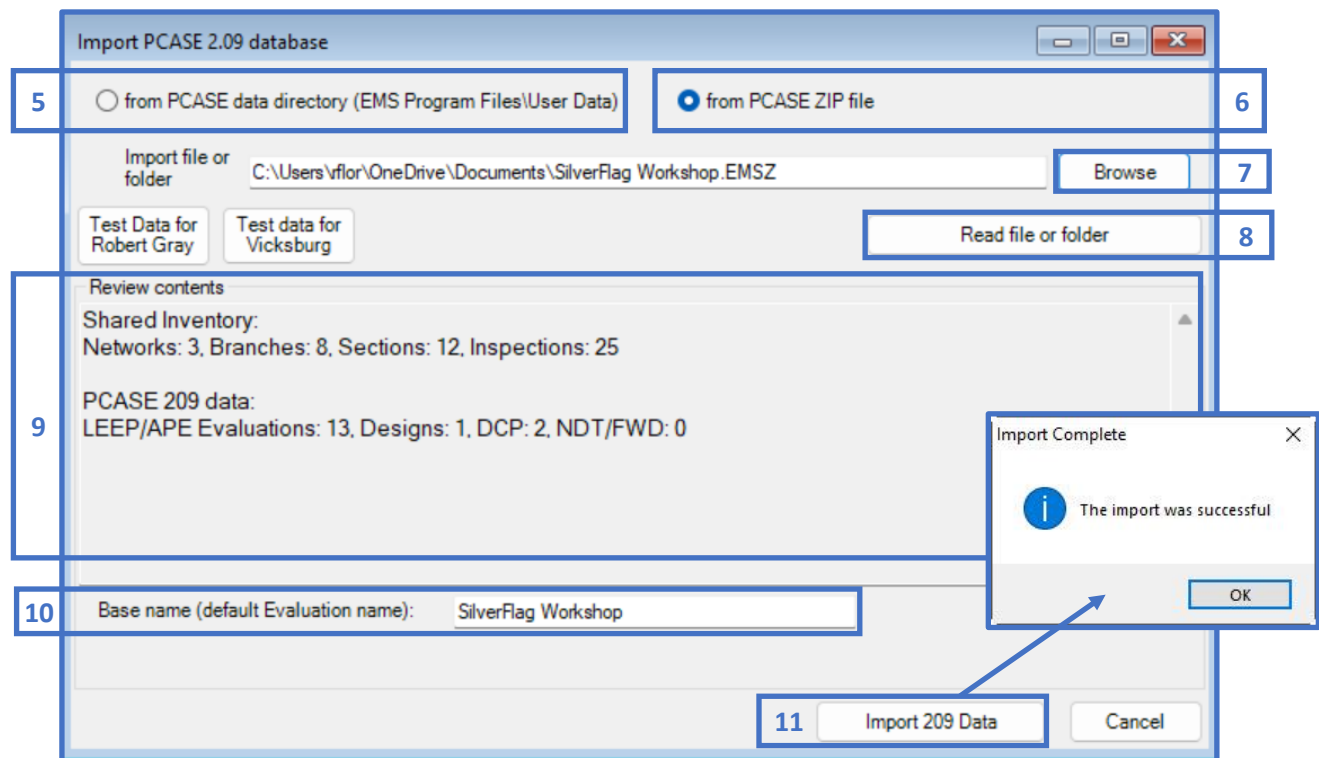
☐ System tables created from defaults and appended with source data

Inventory name

3 **Cancel** **Finish**

Note: The System tables created from defaults and appended with source data option should only be selected if you have made modifications to standard Systems tables in the source database which is not typically allowed by the Unified Facility Criteria.

5. Choose the first radio button option from PCASE data directory (EMS Program Files\User Data) if you have PCASE 2.09 installed on your computer with existing databases.
6. Choose the second radio button from PCASE Zip file, if you have a .zip export from PCASE 2.09.
7. Browse to the appropriate directory or .zip file on File Explorer and select it.
8. Select Read file or folder in order for the program to check the data selected, and to make sure it is compatible.
9. The results of Read file or folder will appear in the Review contents section.
10. PCASE 7.0 allows data from multiple locations and dates to be contained within a single database called "Evaluations".
11. Once all of the required fields have been satisfied, the Import 209 Data button will enable. Select the Import 209 Data button to execute the import process. Once the 2.09 database has been successfully imported, a pop-up window will confirm this action.



2.1.2 GIS/Tabular Import

This option has not been fully implemented in PCASE 7, but it will be included in a future version. The logic must first be modified to handle imported PCASE data properly; as it's currently designed to only work with PAVER™ formatted data.

The GIS/Tabular Import option opens the Create New Database form so that you can create a new database to bring GIS/Tabular Import data into. After the database has been created, another form will open allowing you to continue the GIS or Tabular import process.

1. Select the file type you wish to import from the Inventory Data File to Import section.
2. The Show template file button invokes an Excel template file, which displays the format of the column fields.
3. Modify the Source units selection, if applicable.
4. Browse to the location of the file.
5. If you have Include Asset Items checked, the Update Level options will populate below the Include Asset Items check box once a file path has been established.
6. The Next button will enable once all the necessary fields have been satisfied. Additional forms will open with options to update inventory items, user-defined fields, and to validate and complete the import process.

Add New Inventory Items

Inventory Data File to Import

☒ GIS Shapefile ☐ XLS Spreadsheet ☐ CSV Comma Separated Values

Browse

Source units

☒ English (Units are in LF/SF) ☐ Metric (Units are in mm/M/SM)

Destination Inventory Database

GIS Inventory

☐ Include Asset Items

Show template file Cancel < Back Next > Finish

Update Level

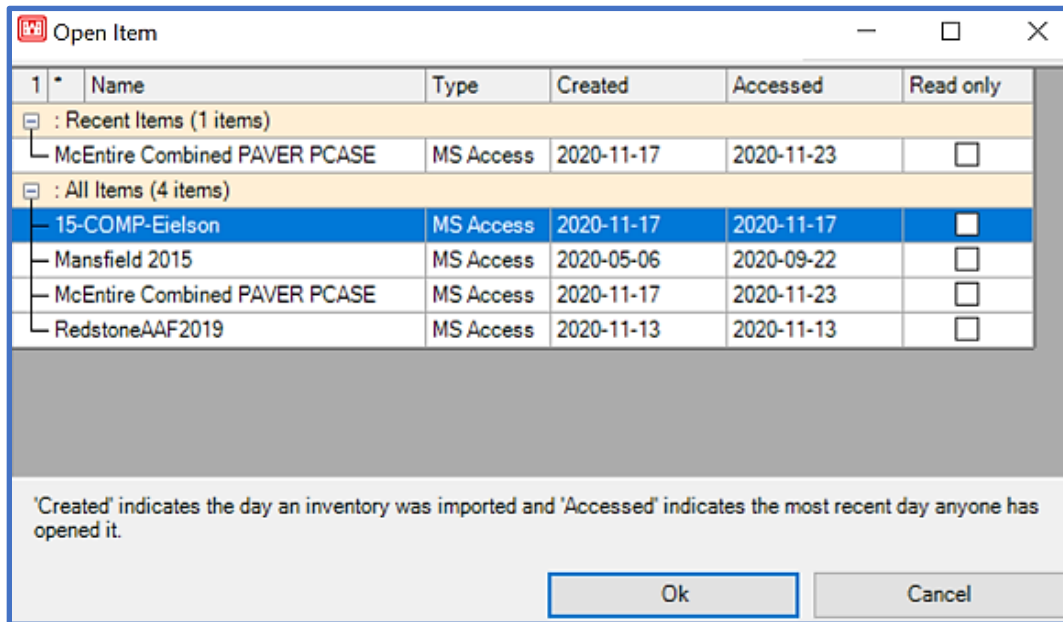
☐ Network Only ☐ Network and Branch ☒ Network, Branch, and Section

Include Asset Items should only be used if Show Asset Items is turned on in File > Database Properties > Preferences

2.2 Open pavement database

The **Open Item** window contains two trees; the top tree displays most recently opened databases and the tree below the **Recent Items** section lists all databases that you've imported into PCASE 7. Select a database from one of these lists, then select the **Ok** button, or double-click the item to open it.

Note: A database must be open in order to use all PCASE 7 functionalities. If a database has not been opened, most options will be disabled.



2.3 Event Manager

The Event Manager has two options: Manage Event Folders and Assign Events. These options allow you to decide what to do with Events/images that are associated with the database you are using. The term “Event” can be thought of as synonymous with “file,” most often an image file. PCASE 7 can systematically recognize Event folders/Events, however, this does not mean the files are available on your computer. Before using the Event management tools, ensure you have the Event Storage Folder you would like to use in PCASE 7 available on your computer.

2.3.1 Manage Event Folders

Upon selecting the Manage Events option, a form will open displaying a grid containing Events/images PCASE 7 recognizes.

1. If there are multiple Event folders associated with PCASE 7, you can select which folder you would like to use from within the Event Storage Folder drop-list.
2. The New button invokes a form in which you can Browse to an Event folder on your computer; a link between the selected Event folder (and the Events/images contained within that folder) will be made with PCASE 7.
3. If you have changed an Event folder’s directory path location and would like to reestablish the link between the Event folder and PCASE 7, select the Edit button.

4. Below the Event folder options are two radio buttons allowing you to choose what you would like to do with the Events that are listed in the grid. The left radio button keeps you in selection mode to choose Events for assignment. The right radio button allows you to **Browse** to and directly upload Events from your computer for assignment.
5. Once you've completed Event selection, proceed to Event assignment.

The screenshot shows two windows from a software interface. The main window is 'Manage Event Folders' and a smaller window 'Manage Event Location' is open to its right.

Manage Event Folders Window:

- Event Type:** A dropdown menu set to 'Image' with an 'Edit' button next to it.
- Event Storage Folder:** A list showing 'Installation X' with a blue box labeled '1' next to it.
- Buttons:** 'New' (labeled '2'), 'Edit', and 'Remove' buttons are below the folder list.
- Radio Buttons:** Two radio buttons are present: 'Find and select Image events in "Installation X"' (selected) and 'Copy Image files to "Installation X"'. A blue box labeled '4' is next to the first radio button.
- Grid:** A table titled 'List of files found in folder. Read only rows in the grid were added previously.' with a 'Refresh files' button. The table has three columns: 'Selected', 'Event', and 'Added previously'. It lists four image files. A blue box labeled '3' is next to the first row.
- Callouts:**
 - A yellow box says 'Select/de-select all Events listed in the grid' with arrows pointing to 'all' and 'none' checkboxes.
 - A yellow box says 'Select an Event in the grid first to view the actual Event/image' with an arrow pointing to the first row of the grid.
- Bottom:** 'Image events total: 65' and a 'Go to event assignment...' button (labeled '5').

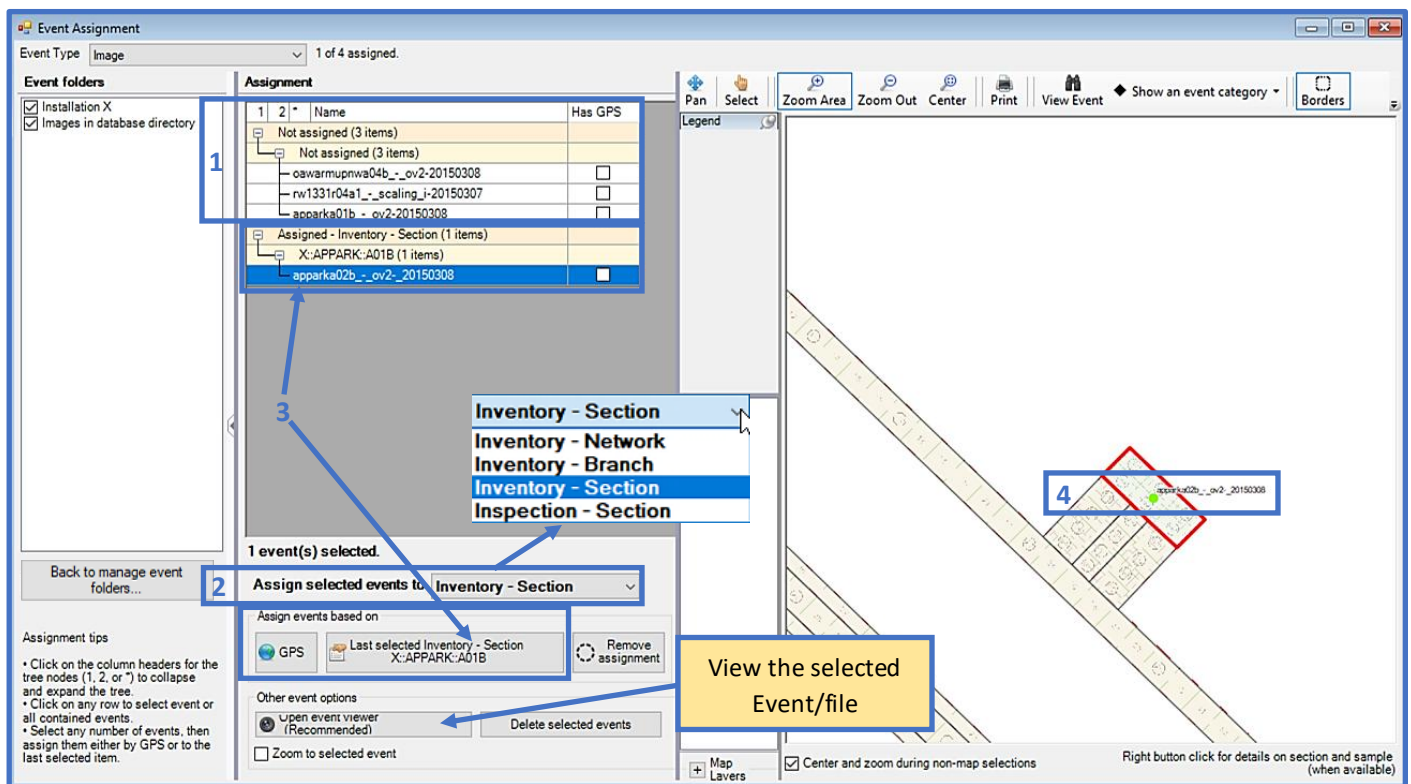
Manage Event Location Window:

- Event type:** A dropdown menu set to 'Image'.
- Directory path:** A text field showing 'C:\Users\rfior\Downloads\Installation X' with a 'Browse' button.
- Short name:** A text field showing 'Installation X'.
- Description:** A large text area.
- Buttons:** 'Cancel' and 'Save' buttons at the bottom.

2.3.2 Assign Events

The Event Assignment form can be accessed directly from the Event Manager options within the File Menu or by clicking on the Go to event assignment... button within the Manage Events form. Events can be assigned at Section, Branch, or Network level.

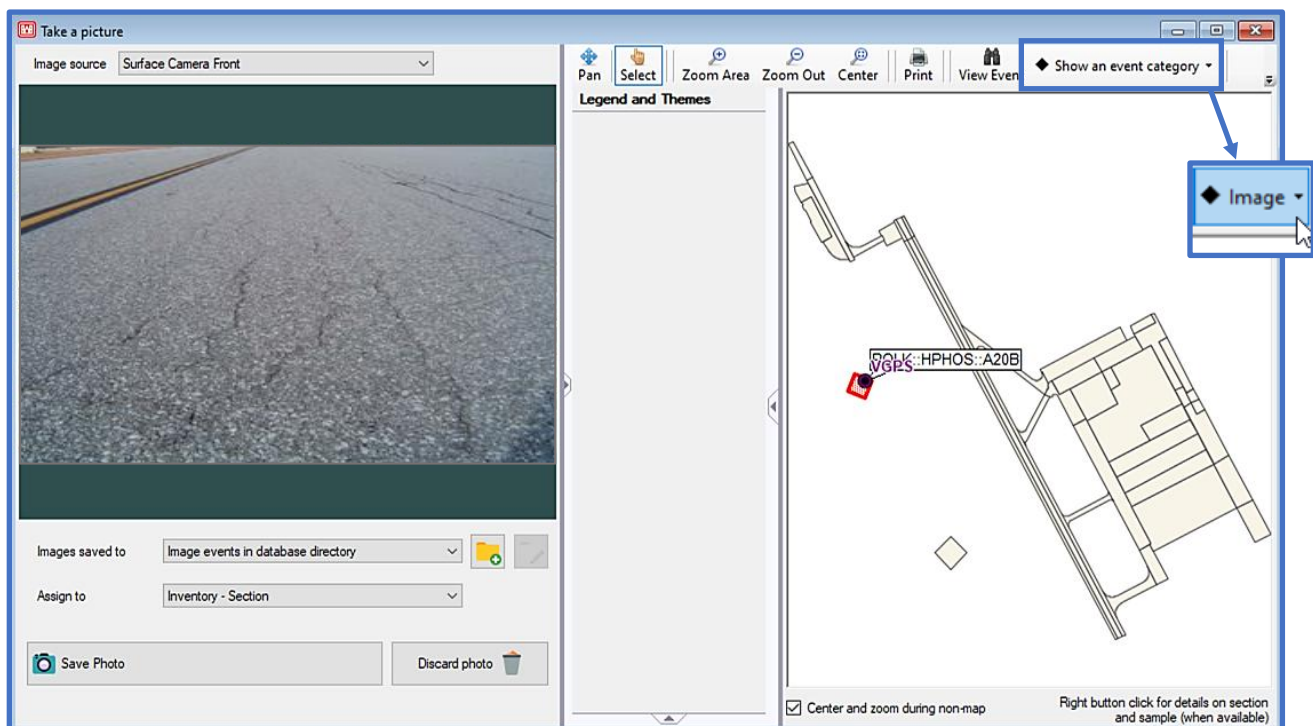
1. Once the Event Assignment form opens, the selections made in the Manage Events form will be displayed in the Assignment tree as Not assigned. Click on the Event(s) listed in the tree to select them for assignment, multi-select works with all selection trees in PCASE 7.
2. Choose which level you would like to assign the selected Events to, from the Assign selected events to drop-list.
3. Select how you would like to assign the selected Events; by GPS or to the Last selected Section to finalize Event assignment. Once you've made your selection in this section, the assigned Event(s) will appear at the bottom of the tree as Assigned. *Note: To use the GPS assignment feature, you will first want to turn on GPS in Preferences > GPS Device. Reference the PAVER™ User Guide for more information on GPS functionality.*
4. The assigned Event will now be visible in the map with a green dot to the left of the Event name label. In PAVER™ maps, green coloring indicates that the item is assigned and red means unassigned.

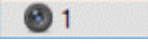


2.4 Take Pictures

The **Take a picture** form provides tools to capture, save, and assign images to defined inventory Network, Branches, and Sections.

To use the picture-taking function, PCASE 7 will need permission to access your camera. Ensure the “Allow desktop apps to access your camera” option is turned on in your computer camera settings before you open the form. An image from your camera should be displayed in the image viewer. The **Images saved to** drop-list contains available image storage options. **Image events in database directory** is the default location where images will be saved, click on the  button if you would like to choose a different location, then follow the prompts to establish a link with the folder you would like to save images to. Choose the inventory level in which images will be assigned by using the **Assign to** drop-list, then select the location within the GIS map you wish to assign images to. Once you're satisfied with the above selections, you can proceed with snapping images using the **Take photo** button. After an image has been captured; options to save or delete the photo will appear. If you opt to **Save Photo** the image will be assigned to the selected location and the camera will reset. **Delete photo** resets your camera so that you may take another photo.

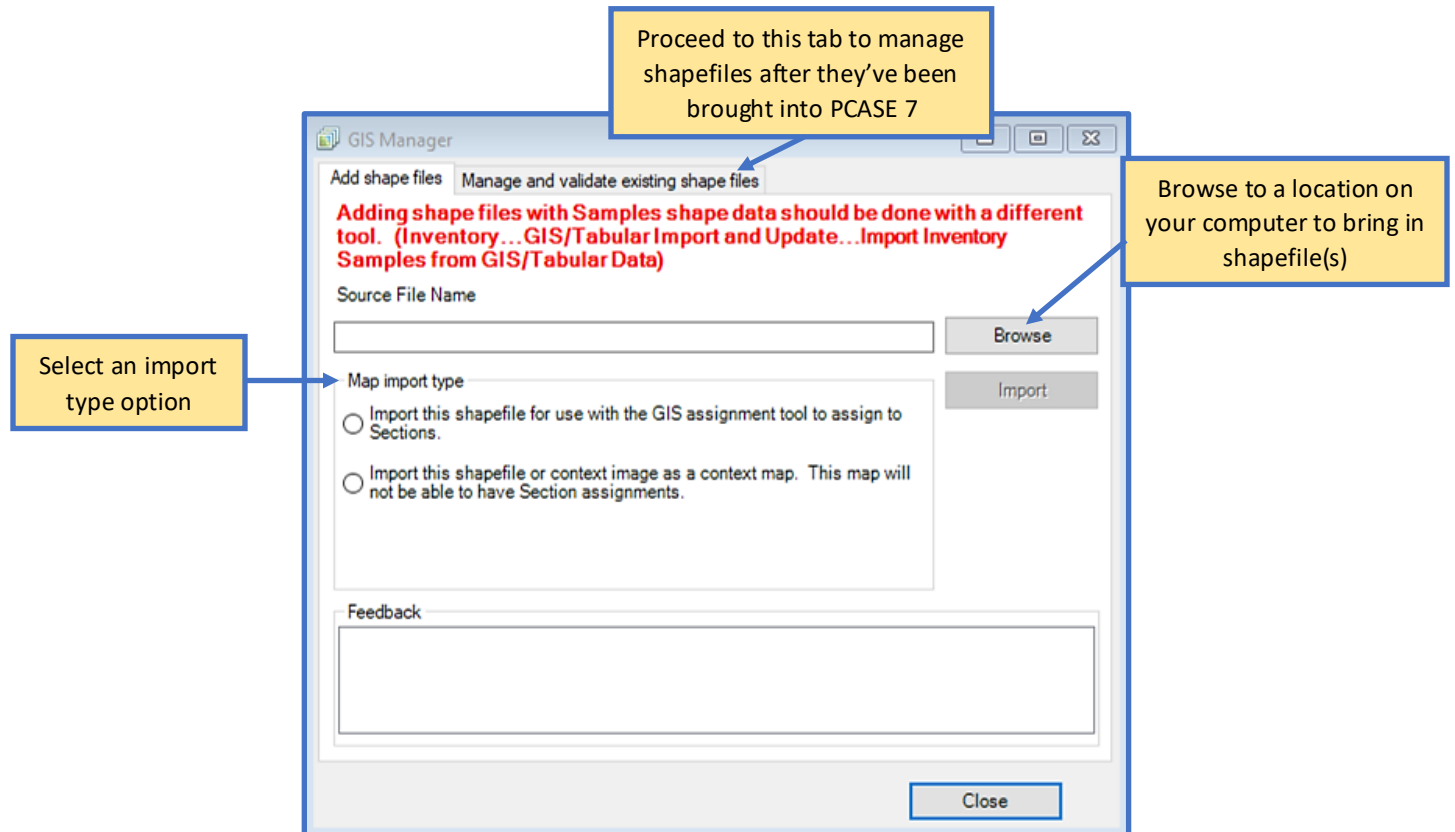


You can view newly assigned images using the **Image Viewer**. Click on **Show an event category**, then select **Image** from the menu. The **Image Viewer** will open when you select a point on the map that contains images. Alternatively, you can view images assigned to inventory via the inventory form by clicking on  located on the bottom-left of the Section form.

2.5 GIS Manager

The **GIS Manager** allows you to attach a shapefile map to a database, shapefiles that are already attached to a database can be deleted or validated using this tool as well. The **GIS Manager** does not add the properties of shapefiles; this function simply adds the shapefile map. If you would like to import shapefile properties as well; use the **GIS/Tabular Import** or **GIS/Tabular Import and Update** tools.

*Note: To add a shapefile that includes sample data (which also needs to be added) use the **GIS/Tabular Import and Update** option in the **File** Menu.*



2.6 GIS Recycle Bin

After you've imported shapefiles into PCASE 7, you may decide to delete some of those files. A list of your deleted shapefiles can be found in the **GIS Recycle Bin**; you can choose to permanently delete, or restore deleted files there.

2.7 GIS/Tabular Import and Update

The **GIS/Tabular Import and Update** options are similar to that of the **GIS/Tabular Import**, as previously mentioned these options have not been fully implemented for use with PCASE data import. You would use this option as opposed to the **GIS/Tabular Import** if you wish to add or update inventory data within an existing database. The main difference between both options is that the **GIS/Tabular Import** creates a new database prior to allowing you to import or update GIS/Tabular data. You can also access this tool from the **Inventory** menu.

2.7.1 Add Inventory from GIS/Tabular Data

Add inventory data from a GIS/Tabular report to the database you currently have open. Selecting this option invokes the **Add New Inventory Items** form to open, which is the same form described in section [2.1.2 GIS/Tabular Import](#).

2.7.2 Update Inventory from GIS/Tabular Data

Update the current inventory within a database using a GIS/Tabular report.

2.7.3 Import Inventory Samples from GIS/Tabular Data

Import inventory samples from a GIS/Tabular report into a database. This process gives users the optional ability to have finer detailed tracking within Branches, and is most useful when a GIS map is also added.

The **Add Sample Centroids** form is arranged similarly to the **Add New Inventory Items** form. Choose an **Inventory Data File to Import**, then **Browse** to the file on your computer. Edit **Source units** if applicable, then select the **Next** button to proceed to the next step.

The screenshot shows the 'Add Sample Centroids' form. It contains several sections: 'Network Fields' with a dropdown for 'NETWORKID'; 'Branch Fields' with a dropdown for 'BRANCHID'; 'Section Fields' with a dropdown for 'SECTIONID'; 'Sample Fields' with dropdowns for 'RPUID', 'Area', 'Slabs', 'Latitude (Y)', 'Longitude (X)', and 'Comments'; and an 'Options' section with two radio buttons: 'Do not apply geospatial data to previously inspected samples.' (selected) and 'Update all geospatial data in previously inspected samples.'. At the bottom, there is a 'PAVER Mandatory Field' section with a 'Show template file' button, and navigation buttons: '< Back', 'Next >', and 'Finish'. A yellow callout box with a blue border points to the 'Next >' button and contains the text: 'Edit the appropriate fields, then proceed to the next step to view and validate the newly added samples.'

Selected	PID	NetworkId	BranchId	SectionId	SampleID	Area	Slabs	Latitude	Longitude	Comments	Status
☐	MAFBTEST::HPAD::A	MAFBTEST	HPAD	A	80801						
☐	MAFBTEST::HPAD::B	MAFBTEST	HPAD	B	80801						
☐	MAFBTEST::HPAD::C	MAFBTEST	HPAD	C	80526						
☐	MAFBTEST::VERSION7::1	MAFBTEST	VERSION7	1	80526						
☐	MAFBTEST::VERSION7::2	MAFBTEST	VERSION7	2	80526						

Message
***** Validation Complete *****

Valid Records: 0 Invalid Records: 5

Show template file Cancel < Back Next > Finish

2.8 Export Open Pavement Database

Use the **Export Open Pavement Database** form to create an .e70 database file that you can share with others. *Note: PCASE data must be exported using PCASE, prior to being imported with PAVER™. The PCASE export process packs up PCASE data and ensures there won't be any data loss when using both programs.*

1. **Export Pavement Data and System Tables** is selected by default in the **Export Options**. Use this option if you would like to include the pavement data listed below the **Export Options** (shown in image 2), as well as the system tables.
2. Un-check items from the list to exclude data you do not want to include in the export.
3. **Browse** to a location on your computer to store the exported .e70 file, give the .e70 a file name, then select **Export**.

E71 files can only be created using PAVER™

1 Export Options
☒ Export Pavement Data and System Tables
☐ Export System Tables only

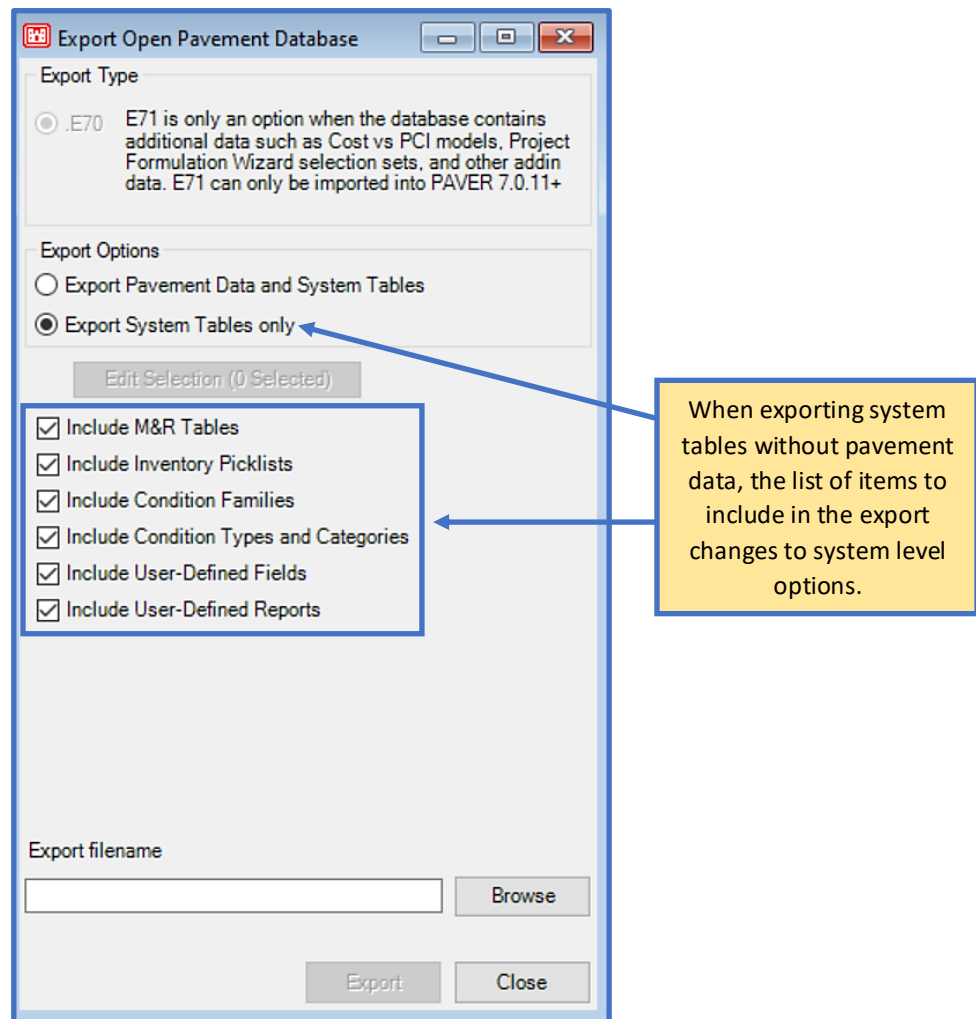
3 Export filename
 Browse

2 Include All Sections
 Edit Selection (0 Selected)
☒ Include non-associated condition families
☒ Include Images
☒ Include Virtual Inventory
☒ Include Required Projects
☒ Include User-Defined Reports
☒ Include Public Work Plans

The Export button will enable once a file name/location has been established. A confirmation message will display after the export process is completed.

Export Close

If you would like to export system tables without pavement data, change **Export Options** to **Export System Tables only**. The list of items to include will change. Follow the same workflow as described above.

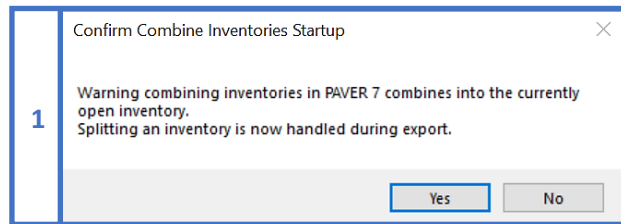


2.9 Combine Inventories

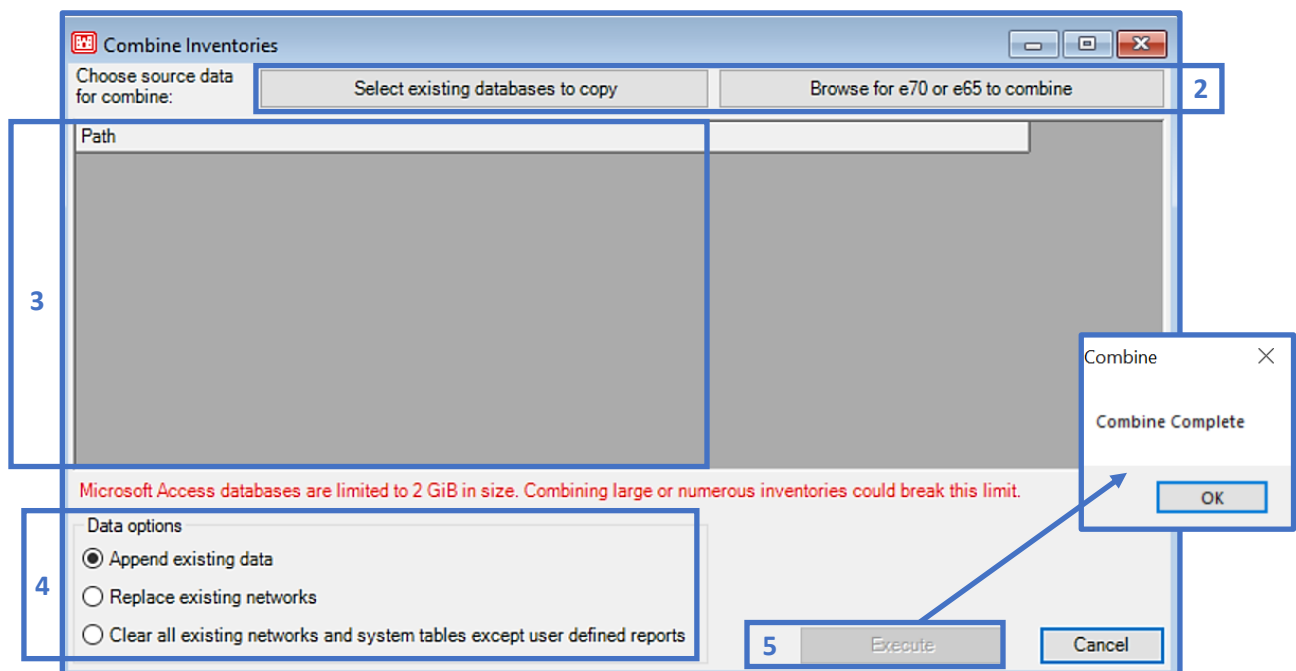
The **Combine Inventories** tool allows you to combine multiple databases or database segments into a single database. The database that is currently open in PCASE 7 is where the combined data will end up after the process has been completed. Before using this tool, create a new database to store the combined data in; following this procedure will result in a new database that contains the combined data and you'll still have the individual, uncombined databases as well.

Note: Microsoft Access databases are limited to 2 GB, using the combine process to combine large or numerous databases may break that limit.

1. Once you've created a new database to store your combined data in, proceed by selecting **Yes** if you are satisfied with combining data into the currently open database.



2. Select the method in which you would like to retrieve the source data for the combined database.
 - Choose the **Select existing databases to copy** button if you would like to copy data to use for the combine directly from the existing database, instead of using a previously exported .e70 or .e65.
 - Choose the **Browse for e70 or e65 to combine** button if you would like to select a previously exported .e70 or .e65 from a location on your computer.
3. After you've selected the databases to combine, their names will display in the **Path** section of the form.
4. Keep the default option to **Append existing data**, unless you would like to perform one of the actions listed below this option.
5. Select **Execute** to complete the combine process. A message will display to confirm the combine was successful.



2.10 Database Properties

The Database Properties form consists of three tabs with settings for: Preferences, Quick Work Plan, and Predicted PCI. Settings that are changed within the Database Properties tab forms are database specific and will persist through the import/export operations.

The 'Edit Database Properties' dialog box is shown with the 'Preferences' tab selected. The dialog has three tabs: 'Preferences', 'Quick Work Plan', and 'Predicted PCI'. The 'Preferences' tab contains the following settings:

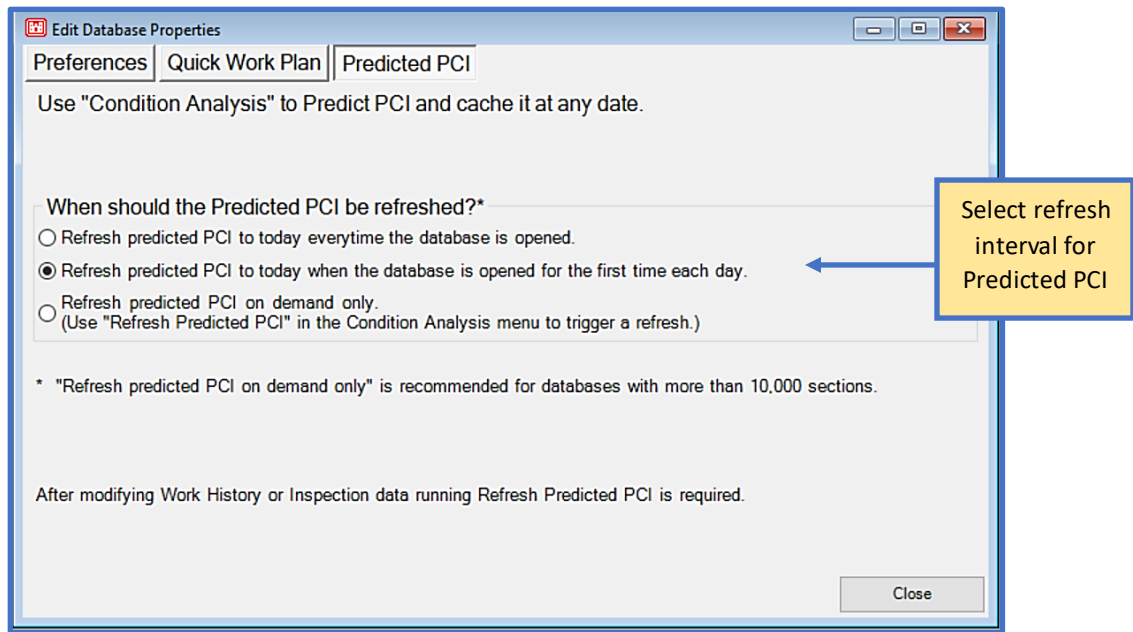
- ☒ Show EA Rating in Reports
- ☐ Show FOD Index in Reports
- ☐ Show Asset Items (US DoD Required)
- CAT Code List Type: Air Force (dropdown menu)
- (MS Access JET)
- System tables mode: Private
- Close button

A yellow callout box labeled 'Database preference options' points to the 'Show EA Rating in Reports' checkbox.

The 'Edit Database Properties' dialog box is shown with the 'Quick Work Plan' tab selected. The dialog has three tabs: 'Preferences', 'Quick Work Plan', and 'Predicted PCI'. The 'Quick Work Plan' tab contains the following settings:

- Quick Work Plan runs a Critical PCI report with unlimited budget. Assigned family values will be used.
- Plan Length: 5 (spin box)
- Parameters for unassigned families
- ☒ Localized Stopgap M&R (PCI < Critical) Stopgap Cost by PCI: New Default AC Rds&RW_Stopgap (dropdown menu) Edit
- ☒ Localized Preventive M&R (PCI >= Critical) Default lifetime credit (years) for models built without preventive: 1 (spin box) Preventive Cost by PCI: New Default AC Rds_Loc Prev (dropdown menu) Edit
- ☐ Global Preventive M&R Global Work Type: Surface Treatment - Slurry Seal (dropdown menu) Edit Cost by Work Type: New Default Rds&RW_Global (dropdown menu) Edit
- ☒ Major M&R Major Cost by PCI: New Default AC Rds_Major (dropdown menu) Edit
- Include Required Work ☐
- Close button

A yellow callout box labeled 'Define criteria to run a quick Work Plan' points to the 'Quick Work Plan' tab.



2.11 Delete Pavement Database

The **Delete Pavement Database** tool allows you to select databases that have been previously opened in PCASE 7, deleted databases are moved to the **Database Recycle Bin**. Once you select one or more items from the list, the **Delete selected items** button will become enabled.

2.12 Database Recycle Bin

Databases that were deleted using the **Delete Pavement Database** tool will remain in the **Database Recycle Bin** until action is taken to either permanently delete, or restore the database(s). Select one or multiple databases from the **Pavement Inventory Recycle Bin** form to enable the **Permanently Delete Selected Databases** or **Restore Selected Items** buttons.

Note: Permanently deleted database files will be removed upon program start after 24 hours.

2.13 Combine or Import PCASE 209 Data

Select the **Combine or Import PCASE 209 Data** option to import PCASE 2.09 data into the currently open database. This operation's workflow is the same as when a new database is created with **Import PCASE 209 data** selected. See [Step 5 in Section 2.1.1](#) for instructions on how to use the **Combine or Import PCASE 209 Data** tool.

2.14 PCASE Data Assignment

Move Network, Branch, or Section data from within an evaluation using the **PCASE Data Assignment** tool. You can choose to move an entire Network from the **Source** box to another Network in the **Destination** box, or incrementally move Branches or Sections from **Source** to **Destination**. You can also move Ad hoc Sections to an existing inventory using this tool.

1. Once the **PCASE Data Assignment** tool opens, the currently selected evaluation will be displayed within the **Evaluation within which to move data** drop-list. All evaluations that exist within the database you currently have open will be available in this drop-list as well. Ensure that you have the correct evaluation selected before you begin.
2. Click on the plus button to expand the grid tree nodes. Select a Network, Branch, or Section(s) from the tree in the **Source** box, then select the **Destination** to move your selection(s) to. If a selection is invalid, a message will display below the **Source** box explaining why the action could not be performed and the **Move** button will remain disabled until valid selections are made. Click on the **Move** button once you're satisfied with your selections.

The screenshot shows the **PCASE Data Assignment** window. At the top, a dropdown menu labeled "Evaluation within which to move data" is set to "MCENTIRE 9/19/2018 (9/19/2018)". Below this are two main panels: "Source (Sections with PCASE Data)" and "Destination (Sections without PCASE data)". Each panel contains a grid with columns 1, 2, 3, 4, and a plus icon. In the Source panel, the plus icon is highlighted with a blue box and a callout that says "Multiple items can be selected at once, as long as each selected source is a Section and the destination is a Branch." In the Destination panel, "McEntireAF" and "McEntireAR" are selected, and a callout states "In this example, a Branch has been selected to be moved to the selected Network. Since this is a valid action, the Move button has become enabled." A "Move" button with a right arrow is located between the two panels. At the bottom, a message box says "Please select both a source and a destination." with a red error icon. A callout points to this message, stating "Messages populate to help guide you through the process." A "Close" button is in the bottom right corner.

1 Evaluation within which to move data
MCENTIRE 9/19/2018 (9/19/2018)

2 Source (Sections with PCASE Data) Destination (Sections without PCASE data)

Multiple items can be selected at once, as long as each selected source is a Section and the destination is a Branch.

In this example, a Branch has been selected to be moved to the selected Network. Since this is a valid action, the Move button has become enabled.

Please select both a source and a destination.

Messages populate to help guide you through the process.

Close

3. The **Destination Selection** form will open after the move-data process has been executed, so you can view a summary of the data prior to completing the **Move** action.
4. Select the **Confirm** button if you're satisfied with the selections displayed. A final warning message will pop-up before the changes are applied.

PCASE Data Assignment

Evaluation within which to move data
MCENTIRE 9/19/2018 (9/19/2018)

Source (Sections with PCASE Data)

1	2	3	4	*
				MCENTIRE
				APRON
				RUNWAY
				TAXIWAY

Destination (Sections without PCASE data)

1	2	3	4	*
				McEntireAF
				McEntireAR

Destination Selection

1	2	3	4	*	Select	From PID	To PID	Information
					☐	MCENTIRE	McEntireAF	
					☐	MCENTIRE::RUNWAY	McEntireAF::RW1432	
					☒	MCENTIRE::RUNWAY::O01C	McEntireAF::RW1432::R01A1	
					☒	MCENTIRE::RUNWAY::O02C	McEntireAF::RW1432::R02C1	
					☒	MCENTIRE::RUNWAY::O03C	McEntireAF::RW1432::R03C1	
					☒	MCENTIRE::RUNWAY::R01A1	McEntireAF::RW1432::R01A2	
					☒	MCENTIRE::RUNWAY::R01A2	McEntireAF::RW1432::R02C2	
					☒	MCENTIRE::RUNWAY::R02C1	McEntireAF::RW1432::R04C1	
					☒	MCENTIRE::RUNWAY::R02C2	McEntireAF::RW1432::R03C2	
					☒	MCENTIRE::RUNWAY::R03C1	McEntireAF::RW1432::R04C2	
					☒	MCENTIRE::RUNWAY::R03C2	McEntireAF::RW1432::R15C2	
					☒	MCENTIRE::RUNWAY::R04C1	McEntireAF::RW1432::R15C1	

Apply Changes

This will move the evaluation data for 10 sections from MCENTIRE::RUNWAY to McEntireAF. You will not be able to undo this operation except by re-locating in the other direction. Proceed?

Yes No

3

4 Confirm Close

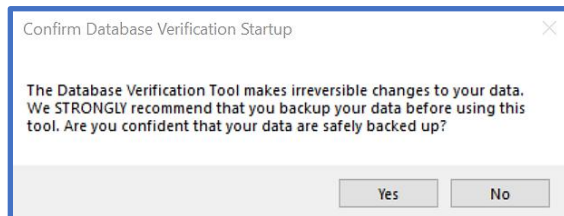
The tree in the **Destination** box will display the updated tree structure after the changes have been applied.

Destination (Sections without PCASE data)

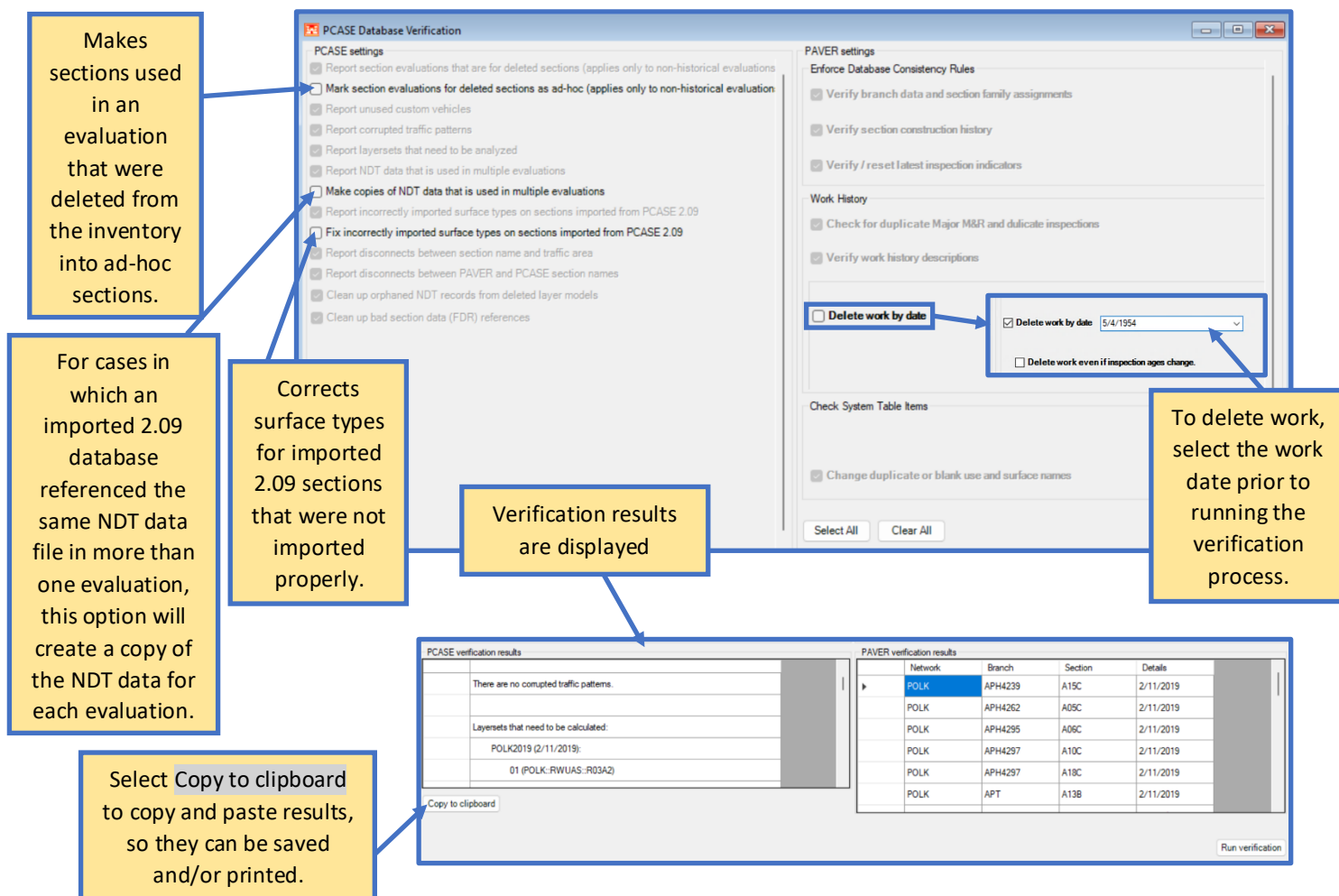
1	2	3	4	*
				MCENTIRE
				RUNWAY
				McEntireAF
				McEntireAR

2.15 PCASE Database Verification tool

Prior to using the database verification tool, please ensure that you have backed up your data. When the tool is selected from the menu, a confirmation message pops up to remind you of this and warns that data changes are irreversible. If you wish to continue, click on **Yes** to open the tool.



The left-side of the window lists options for **PCASE settings**. Some of the options are set to read-only and will automatically be applied when **Run verification** is selected. The remaining selectable settings are optional, see below for explanations of these settings. The right-side of the window lists **PAVER™ settings**, most of which are selected by default. After you are satisfied with your selections, click on **Run verification**. Verification results populate in the space below each settings list.



The image shows the PCASE Database Verification tool interface with several annotations explaining specific settings and results.

PCASE settings:

- ☐ Report section evaluations that are for deleted sections (applies only to non-historical evaluations)
- ☐ Mark section evaluations for deleted sections as ad-hoc (applies only to non-historical evaluations)
- ☒ Report unused custom vehicles
- ☒ Report corrupted traffic patterns
- ☒ Report layersets that need to be analyzed
- ☒ Report NDT data that is used in multiple evaluations
- ☐ Make copies of NDT data that is used in multiple evaluations
- ☒ Report incorrectly imported surface types on sections imported from PCASE 2.09
- ☐ Fix incorrectly imported surface types on sections imported from PCASE 2.09
- ☒ Report disconnects between section name and traffic area
- ☒ Report disconnects between PAVER and PCASE section names
- ☒ Clean up orphaned NDT records from deleted layer models
- ☒ Clean up bad section data (FDR) references

PAVER settings:

- Enforce Database Consistency Rules**
 - ☒ Verify branch data and section family assignments
 - ☒ Verify section construction history
 - ☒ Verify / reset latest inspection indicators
- Work History**
 - ☒ Check for duplicate Major M&R and duplicate inspections
 - ☒ Verify work history descriptions
- ☐ Delete work by date
 - ☒ Delete work by date: 5/4/1954
 - ☐ Delete work even if inspection ages change.
- Check System Table Items**
 - ☒ Change duplicate or blank use and surface names

Annotations:

- Makes sections used in an evaluation that were deleted from the inventory into ad-hoc sections.** (Points to "Mark section evaluations for deleted sections as ad-hoc")
- For cases in which an imported 2.09 database referenced the same NDT data file in more than one evaluation, this option will create a copy of the NDT data for each evaluation.** (Points to "Make copies of NDT data that is used in multiple evaluations")
- Corrects surface types for imported 2.09 sections that were not imported properly.** (Points to "Fix incorrectly imported surface types on sections imported from PCASE 2.09")
- Verification results are displayed** (Points to the results tables)
- To delete work, select the work date prior to running the verification process.** (Points to "Delete work by date" setting)
- Select Copy to clipboard to copy and paste results, so they can be saved and/or printed.** (Points to "Copy to clipboard" button)

PCASE verification results:

Network	Branch	Section	Details
POLK	APH4239	A15C	2/11/2019
POLK	APH4262	A05C	2/11/2019
POLK	APH4295	A06C	2/11/2019
POLK	APH4297	A10C	2/11/2019
POLK	APH4297	A18C	2/11/2019
POLK	APT	A13B	2/11/2019

PAVER verification results:

Network	Branch	Section	Details
POLK	APH4239	A15C	2/11/2019
POLK	APH4262	A05C	2/11/2019
POLK	APH4295	A06C	2/11/2019
POLK	APH4297	A10C	2/11/2019
POLK	APH4297	A18C	2/11/2019
POLK	APT	A13B	2/11/2019

Run verification button

2.16 Exit

The **Exit** option will close the PCASE 7 program, or you can click on the “x” in the top-right corner of the main window to exit the program.

3 System Tables and Tools

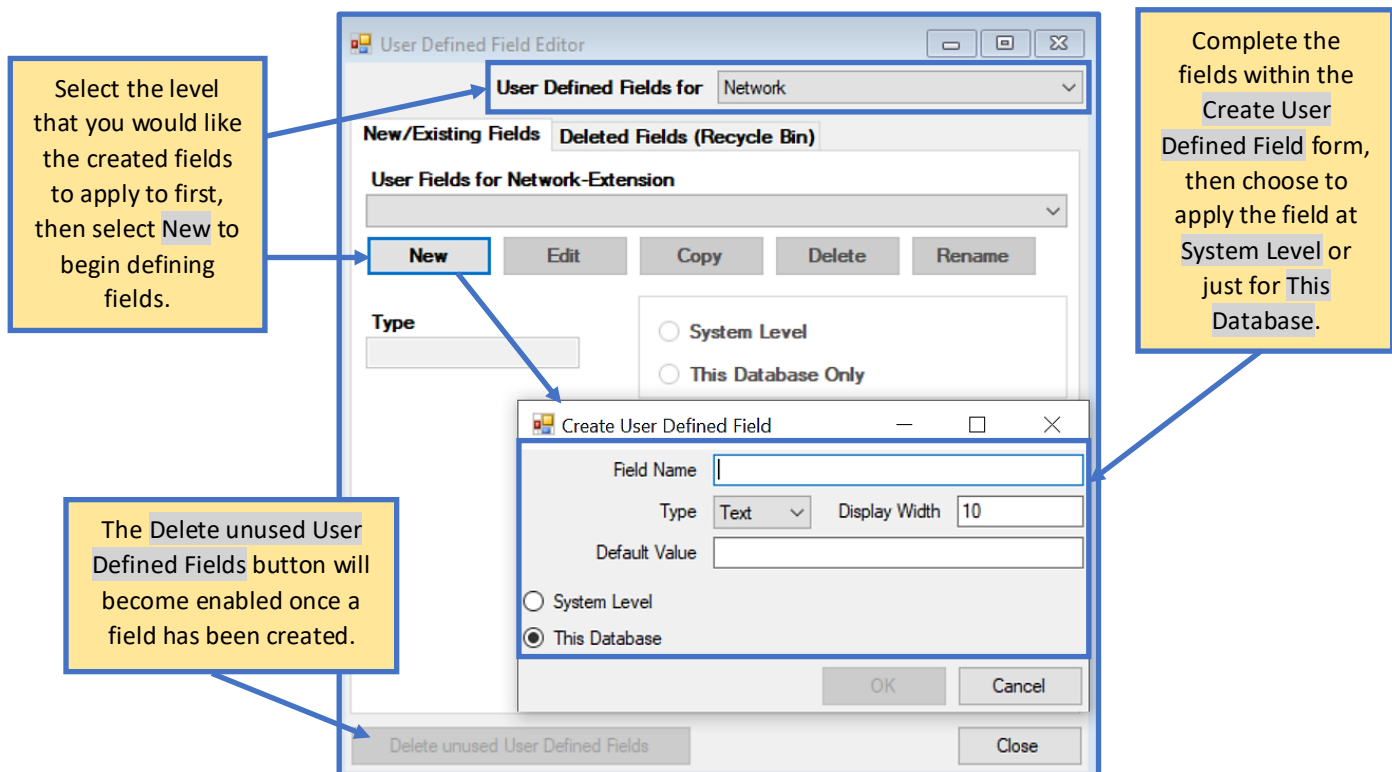
The **System Tables and Tools** menu consists of options for customizing and managing inventory fields/picklists. Tools related to vehicles, such as the **Vehicle Editor**, **ACN/ACR Curves**, and **Import User Defined Vehicles** can be found within the **Vehicles** menu.

3.1 User Defined Inventory Fields

The inventory system is designed so that users may assign user-defined fields to each level of the inventory (Network, Branch, and Section). Doing so allows sorting of the database at any level, according to the criteria you have defined. The fields you create will automatically display within the coinciding inventory form tab in the **User defined fields** section.

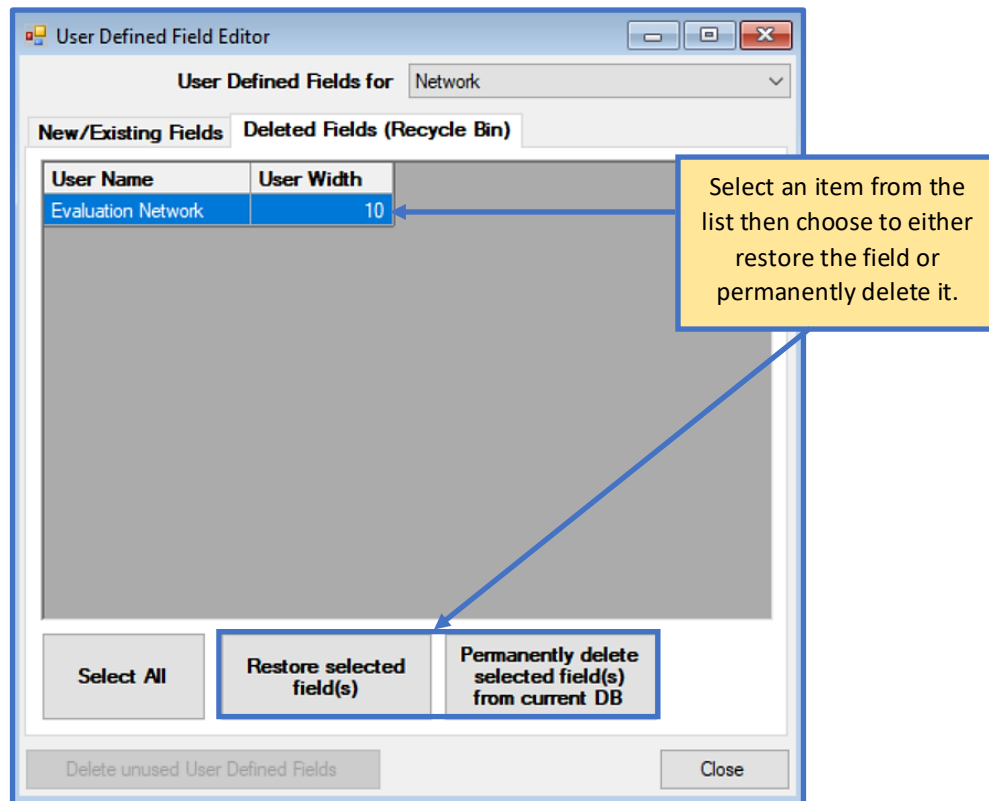
3.1.1 New/Existing Fields

The **User Defined Field Editor** form contains two tabs; **New/Existing Fields** for creating and managing defined fields and **Delete Fields (Recycle Bin)**, which can be used to permanently delete or restore deleted fields.



3.1.2 Delete Fields (Recycle Bin)

Any fields that you opted to delete within the **New/Existing Fields** tab will be listed in the table. Use the buttons below the table to choose what you would like to do with deleted fields.



3.2 Edit Inventory Picklists

There are two field customizing options for inventory picklists, which are grouped by engineering terms or descriptive fields for use within the program. To add fields related to **Branch Use**, **Surface Type**, or **Section Rank**; select the **Engineering Fields** option. Select **Descriptive Fields** to add fields which correlate to **Zone**, **Section Category**, **Shoulder**, or **Street Type**. *Note: If you have **Show Asset Items** turned on (**File > Database Properties > Preferences**) additional category tabs will be displayed including **FAC**, **CATCD**, **Site**, and **Facility**.*

3.2.1 Engineering Fields

Select the tab category you would like to add a new field to. You may also edit existing fields that are listed in the grid rows, as long as the cell row is not colored yellow (yellow cells are read-only to prevent editing required fields). Click on the **Add** button to populate a new, editable row in the grid.

New rows will automatically populate at the bottom of the grid by default. Sort columns by clicking on the column headers or assigning a **Sort Order** to fields.

Engineering Inventory Droplists

1) Branch Use 2) Surface Type 3) Section Rank

Use	Description	Use Category	Priority	Sort Order
APRON	APRON	Airfield	L	Alpha
HELIPAD	HELIPAD	Airfield	M	Alpha
MTRPOOL	MTRPOOL	Roadway / Parking	M	Alpha
OTHER	OTHER	Roadway / Parking	M	Alpha
PARKING	PARKING	Roadway / Parking	L	Alpha
DRIVEWAY	DRIVEWAY	Roadway / Parking	L	Alpha
ROADWAY	ROADWAY	Roadway / Parking	H	Alpha
RUNWAY	RUNWAY	Airfield	H	Alpha
STORAGE	STORAGE	Roadway / Parking	L	Alpha
TAXIWAY	TAXIWAY	Airfield	M	Alpha
OVERRUN	OVERRUN	Airfield	M	Alpha
SHOULDER-AF	SHOULDER for Airfields	Airfield	L	Alpha
SHOULDER-RD	SHOULDER for Roadways	Roadway / Parking	L	Alpha
CLOSED-AF	CLOSED Airfield	Airfield	L	Alpha
CLOSED-RD	CLOSED Roadway	Roadway / Parking	L	Alpha
HANGAR APR	Hangar Apron	Airfield	L	Alpha

Close Add Delete

Editable row

3.2.2 Descriptive Fields

The **Descriptive Inventory Droplists** form works in the same manner as the **Engineering Inventory Droplists** form. Select the **Add** button to populate a row to input information.

Descriptive Inventory Droplists

1) Zone 2) Section Category 3) Shoulder 4) Street Type 5) Manage Descriptive Fields

Category	Description	Sort Order
K	Transient Aircraft Parking	Alpha
L	Alternate/Ladder Taxiway	Alpha
N	Non-Family Housing	Alpha
O	Other	Alpha
R	Primary/Instrument Runway	Alpha
T	Primary/Parallel Taxiway	Alpha
Y	Family Housing	Alpha
Z	Runway Overrun	Alpha
New		Alpha

Close Add Delete

Make field additions/edits within the grid.

The Delete button will only be available when the highlighted row is allowed to be deleted. You will be prompted to confirm each time Delete is initiated.

3.3 Condition Tools

The Condition Tools provide options for editing the condition index selection system table.

3.3.1 Select Condition Types

Select which numeric, textual, or distress condition types to make available for use in PCASE. Fields highlighted in yellow cannot be edited. New condition types may be added by selecting the Add button and inputting data in the new row that populates. The Delete button will become enabled once the selected row is allowed to be deleted.

Name	Description	Selected	Decreases With Age	Minimum Value	Maximum Value
ACN	ACN	☒	☐	0	999999999
ACN/PCN	ACN/PCN	☒	☐	0	10
ACN/PCN Frost	ACN/PCN Frost	☒	☐	0	999999999
Allowable Gross Load	Allowable Gross Load	☒	☐	1	999999999
Allowable Gross Load Frost	Allowable Gross Load Frost	☒	☐	1	999999999
Allowable Passes	Allowable Passes	☒	☐	1	999999999
Allowable Passes Frost	Allowable Passes Frost	☒	☐	1	999999999
IRI	International Roughness Index	☐	☐	1	1000
PCN	PCN	☒	☐	0	999999999
PCN Frost	PCN Frost	☒	☐	0	999999999

3.3.2 Define Condition and Age Categories

Establish categories and value ranges for conditions or age by editing the data in the table. For the Condition Categories tab, use the drop-list to select a condition type and edit the fields directly within the table that populates. Categories can also be added or deleted. The Age Categories tab displays a table of age brackets; which can be used to group pavements.

Name	LowValue	HighValue	Color
Unsatisfactory	1.4	100	255, 0, 0
Marginal	1.1	1.39999	255, 255, 0
Adequate	0	1.09999	0, 255, 0

3.4 Vehicles

The tools that are available within the **Vehicles** menu offer different capabilities with respect to the vehicles used in PCASE 7.

The **Vehicle Editor** displays vehicle attributes, can also be used to make copies of existing vehicles that are customizable, or new vehicles can be added. Custom vehicles can then be used in designs and/or in evaluations.

The **ACN/ACR Curves** form displays and calculates ACN lines or ACR curves for any selected vehicle. A report can also be generated.

Custom vehicles can be imported into PCASE 7 using the **Import User Defined Vehicles** tool.

3.4.1 Vehicle Editor

Vehicles in the Vehicle Editor can be selected by using the **Selected Vehicle** drop-list or the vehicle **Catalog**.

Vehicle Editor

Selected Vehicle: C-130J HERCULES

Vehicle Properties

Vehicle Category: Aircraft

Standard Load (lb): 175000

Maximum Load (lb): 175000

Minimum Load (lb): 75560

Percent Load on Main Gear: 95.84

Surface Thickness Group #: 2

Base Thickness Group #: 2

Comments:

Catalog Category: Cargo/Transport/Soc

Vehicle Catalog

Vehicle Filter:

- ☒ Aircraft
- ☐ Ground
- ☒ 14 Groups
- ☒ Airbus
- ☒ Attack/Observation/Battle Management
- ☐ Civilian
- ☒ Boeing
- ☒ Bomber
- ☒ British Aerospace
- ☒ Cargo/Transport/Special Duty
- ☐ Com
- ☐ FA/5
- ☐ Fighter
- ☐ Helic

Vehicle grouping: ☒ by categories, ☐ no grouping, order by alphanumeric

Search in name, category, standard load: c-130j

Available vehicles:

Cargo/Transport/Special Duty

- C-130J HERCULES (Standard load 175,000 lb)
- C-130J-30 HERCULES (Standard load 175,000 lb)
- EC-130J COMMANDO SOLO (Standard load 175,000 lb)
- EC-130J SUPER J (Standard load 171,822 lb)

Reconnaissance

- WC-130J HERCULES (Standard load 175,000 lb)

Time	X (in.)	Y (in.)	Load %	Contact pressure (psi)
1	85.63	60.00	23.96	118.00
2	85.63	0.00	23.96	118.00
3	11.00	415.00	2.08	60.00
4	-11.00	415.00	2.08	60.00
5	-85.63	60.00	23.96	118.00
6	-85.63	0.00	23.96	118.00

Select a vehicle to modify characteristics of an existing vehicle, then click on the **Copy** button. A customizable version of the selected vehicle is created. If you wish to create a new custom vehicle, skip to the next page.

The copied vehicle can now be edited; areas of the form that were once colored gray (read-only or disabled) are now enabled. To prevent modification of standard vehicles in the database, the form only allows edits to custom vehicles. Changes made to the form are automatically saved after the form is closed. However, if the vehicle is left in an invalid state when you attempt to close the form, a warning message will display with further instructions.

Edit Vehicles

Selected Vehicle: *Copy of C-17A GLOBEMASTER III

Buttons: Catalog, Add, Copy, Rename, Delete, Report, Pass/Coverage, Export Custom Vehicles

Vehicle Properties

☒ User Defined

Vehicle Category: ☒ Aircraft ☐ Ground

Standard Load (lb): 585000

Maximum Load (lb): 585000

Minimum Load (lb): 279000

Percent Load on Main Gear: 92.004

Surface Thickness Group #: 2

Base Thickness Group #: 2

Comments:

Catalog Category:

☐ Is Military

Filename:

Chart

Y (in.): 0 to 800

X (in.): -800 to 800

Legend:

- Tires
 - Calculation flag
 - Overlapping Tire
 - Tire
- Points
 - Evaluation Points

Chart accessibility: [Navigation icons] Reset zoom [Scroll wheel: zoom, Middle mouse button: pan, Left click drag: zoom area, Right mouse button: reset]

Calculation Flag Selector: ☒ PCC ☐ Tire Numbers ☒ Evaluation Points

Evaluation Points

X (in.)	Y (in.)
170.00	48.50
170.00	0.00
151.00	97.00
149.50	48.50
149.50	0.00

Tires

	X (in.)	Y (in.)	Load %	Contact pressure (psi)	Tire Load At Vehicle Max. Weight. (lb)	Calculated contact area (in²)	Shape	Aspect Ratio	PCC	ESWL	ACN	PCR	LED	BETA	Nose Gear
1	192.00	97.00	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
2	190.50	0.00	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
3	151.00	97.00	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
4	149.50	0.00	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
5	108.00	108.50	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
6	106.50	11.50	7.67	141.60	44,869.50	316.88	Ellipse	1.652	☒	☒	☒	☒	☒	☒	☐
7	14.50	794.50	4.00	155.00	23,400.00	150.97	Ellipse	1.652	☐	☐	☐	☐	☐	☐	☒
8	-14.50	794.50	4.00	155.00	23,400.00	150.97	Ellipse	1.652	☐	☐	☐	☐	☐	☐	☒

☒ Automatically mirror edits for opposite tire ☐ Use Constant Contact Area

Buttons: Add Tire, Delete Tire

Tire Contact Option

Only select the **Constant Tire Contact Area** option when comparing analysis results performed with versions older than PCASE 2.09.07. This option does not affect LEEP analyses with WE55, because the WE55 layered elastic model will enforce constant contact area.

For routine pavement analyses, the tire surface contact pressure is typically approximated by the inflation pressure. When the design or evaluation load changes, PCASE7 keeps the contact surface pressure constant and re-calculates the tire surface contact area. The contact area is allowed to vary as long as it is equal to or less than the maximum load of the ground vehicle or aircraft. Above the maximum load, the tire contact area will increase to unreasonable values. To avoid the calculation of unrealistic contact areas as the load increases, a reduction function is used to adjust the contact pressure and maintain the contact area within reasonable values.

Mirrors tire value changes on opposing tire to save time

Before creating a new vehicle with the Vehicle Editor; first obtain the vehicle information identified in the tables below from the vehicle manufacturer.

Vehicle Information	
Name of Vehicle	
Standard Load (lbs)	
Maximum Load (lbs)	
Minimum Load (lbs)	
Surface Thickness Group #	
Base Thickness Group #	

Tire Number	X-coordinate (in)	Y-coordinate (in)	Load %	Tire Pressure (psi)	Contact Area (in ²)	Tire Shape
1						
2						
3						
4						
Etc.						

Once you've obtained the required above information, click on the **Add** button to begin inputting vehicle data.

1. The **Add Vehicle** form opens. Input a **Name** and select a **Vehicle Category**.
2. In the **Vehicle Properties** section, edit the vehicle's **Standard Load**, **Maximum Load**, and **Minimum Load** values. *Note: The minimum/maximum load information should come from the vehicle manufacturer. Standard load information is Service-specific.*
3. Choose the vehicle **Surface Thickness Group #** and **Base Thickness Group #**. Click on the info icons  if you need guidance in selecting group #'s. *Note: If you do not know this information, reference a similar vehicle's group #'s.*
4. Add **Comments** about the vehicle, if so desired.
5. The first row in the **Tires** grid auto-populates upon custom vehicle creation with default values; edit these values within the grid cells. Validation logic within the **Tires** grid will notify you of invalid values and what the acceptable range is in some cases.
6. Click on the **Add Tire** button to input information for each additional tire. Be sure to complete all column fields before proceeding with adding the next tire.

7. Add **Evaluation Points** for each tire. Once each tire has **Evaluation Points** assigned, click on the **Calculate** button.
8. **Close** the form to save the new vehicle. Your new custom vehicle will now be available for use in PCASE 7.

1 Add Vehicle dialog box: Name: Custom Vehicle, Vehicle Category: Aircraft (selected), Ground (unselected). Buttons: Ok, Cancel.

2 Vehicle Properties section: User Defined, Vehicle Category: Aircraft (selected), Ground (unselected). Standard Load (lb): 10000, Maximum Load (lb): 10000, Minimum Load (lb): 5000, Percent Load on Main Gear: 0.01, Surface Thickness Group #: 1, Base Thickness Group #: 1, Comments: [empty].

3 Surface Thickness Group #: 1

4 Comments: [empty]

5 Tires table:

	X (in.)	Y (in.)	Load %	Contact pressure (psi)	Tire Load At Vehicle Max. Weight. (lb)	Calculated contact area (in²)	Shape	Aspect Ratio	PCC	ESWL	ACN	PCR	LED	BETA	Nose Gear
1	10.00	0.00	0.01	100.00	1.00	0.01	Ellipse	1.652	✓	✓	✓	✓	✓	✓	✓

6 Add Tire button

7 Evaluation Points table:

X (in.)	Y (in.)
0.00	0.00

8 Close button

The Close button will enable once the custom vehicle's tire loads sum to 100% or all vehicle errors have been resolved

Each vehicle is limited to a maximum of 100 tires/evaluation points. Once the limit has been reached the Add Tire button will disable and a notification message is displayed.

Auto-populate the opposing tire row

Vehicles are limited to no more than 100 tires

3.4.2 ACN/ACR Charts

The ACN/ACR charts form can be accessed from the **System Tables and Tools > Vehicles** menu, or from the Traffic form within the Design, APE and LEEP modules.

Click and drag the black load line within the chart to update the load and ACN/ACR values or input a value in the Aircraft Gross Load field.

Maximum load values are displayed in bold

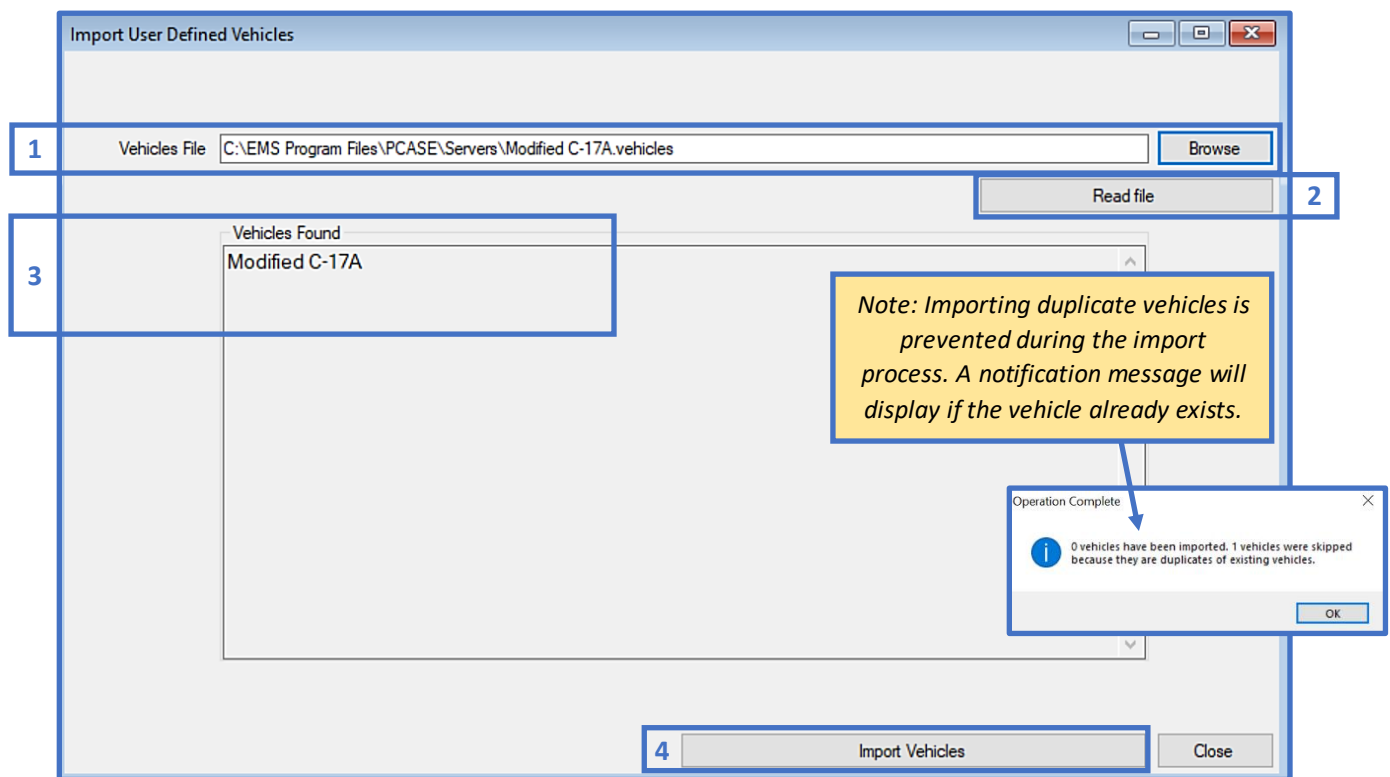
Outputs an Excel spreadsheet

Load (kips)	ACN Value for Flexible Subgrade Category (CBR, %)				ACN Value for Rigid Subgrade Category (k, pci)			
	A (CBR ≥ 13)	B (8 < CBR < 13)	C (4 < CBR ≤ 8)	D (CBR ≤ 4)	A (K ≥ 442)	B (221 < K < 442)	C (92 < K ≤ 221)	D (K ≤ 92)
279.000	15.8	16.8	19.3	24.5	19.0	20.1	21.3	23.2
585.000	41.0	45.1	54.3	70.5	42.7	46.6	53.8	65.7
877.500	65.1	72.3	87.7	114.5	65.4	71.9	84.9	106.4

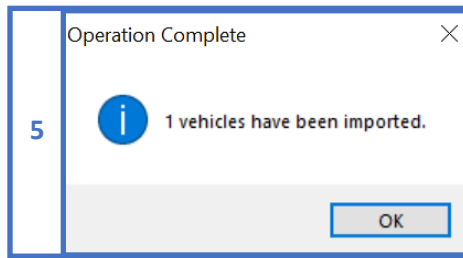
3.3.3 Import User Defined Vehicles

Import custom vehicles from a PCASE 2.09 or PCASE 7 vehicles database on your computer using the **Import User Defined Vehicles** tool. Before you begin, ensure that the vehicles.mdb file containing the custom vehicles you would like to import are accessible from your computer.

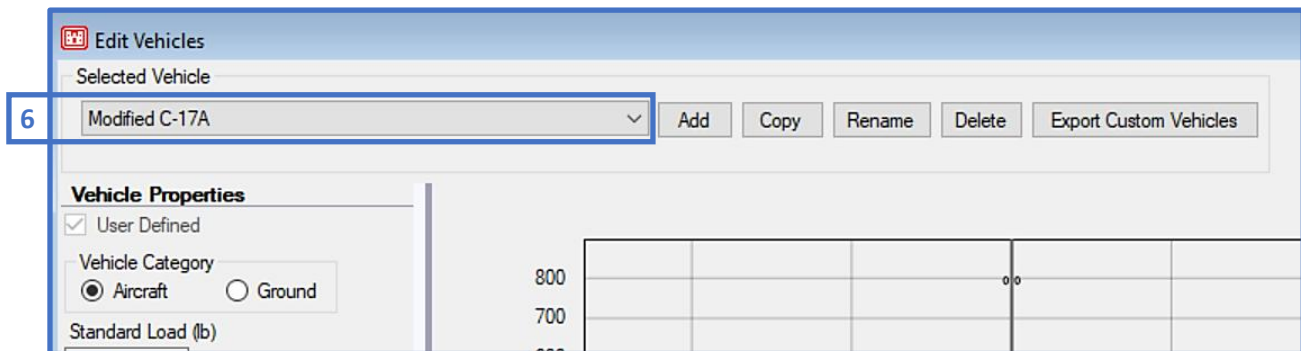
1. The default vehicles database storage location on your computer when PCASE is installed auto-populates within the **Vehicles File** field. If the actual location of the vehicles database is different than the file path displayed in this field, **Browse** to the correct file location. Once the correct vehicles.mdb file path has been established, proceed to Step 2.
2. Click on the **Read file** button.
3. During this process, PCASE 7 searches for custom vehicles within the vehicles database and populates those vehicles in the **Vehicles Found** box below.
4. The **Import Vehicles** button becomes enabled once custom vehicles have been identified. Select the **Import Vehicles** button to continue.



5. A confirmation message will display once the import process is successful.



6. The imported vehicle(s) will now be available for use in PCASE 7. To verify the vehicle(s) were imported successfully, open the **Vehicle Editor** and search for the vehicle in the **Selected Vehicle** list.



3.4.4 Update Standard Vehicles

A link to the most current standard vehicles database is provided in the **Update Standard Vehicles from Tri-Service Web Site** window. Instructions for completing the update are provided below the link.



4 User Preferences

PCASE 7 preference options consist of Units settings, window view settings, default settings, and GPS settings. These settings apply to the entire program, unless specified otherwise. Changes made within the **Menus** and **PCASE Defaults** tabs require a program restart to take effect.

4.1 English Units

The default Units setting in PCASE 7 is **English Units**. Click on a Units option to change it. Changes to this setting will affect the entire program.

4.2 Metric Units

Click on **Metric Units** to switch from English to Metric. Changes to this setting will affect the entire program.

4.3 EMS Desktop

The EMS Desktop view is the default setting in PCASE 7. All forms open within the main PCASE 7 program window and cannot be moved outside of the window. Multiple forms can be open at the same time and overlap each other. The most recently opened form, is positioned in front of the previously opened form. Clicking on any open form will bring it forward.

4.4 Windows Desktop

Switch to the **Windows Desktop** view by clicking on this option in the menu. Move any open form outside of the main PCASE 7 window using this option, the independent form positioning allows you to view various forms on multiple monitors.

4.5 Language

Currently the only available **Language** option is English. Additional languages may be added in the future.

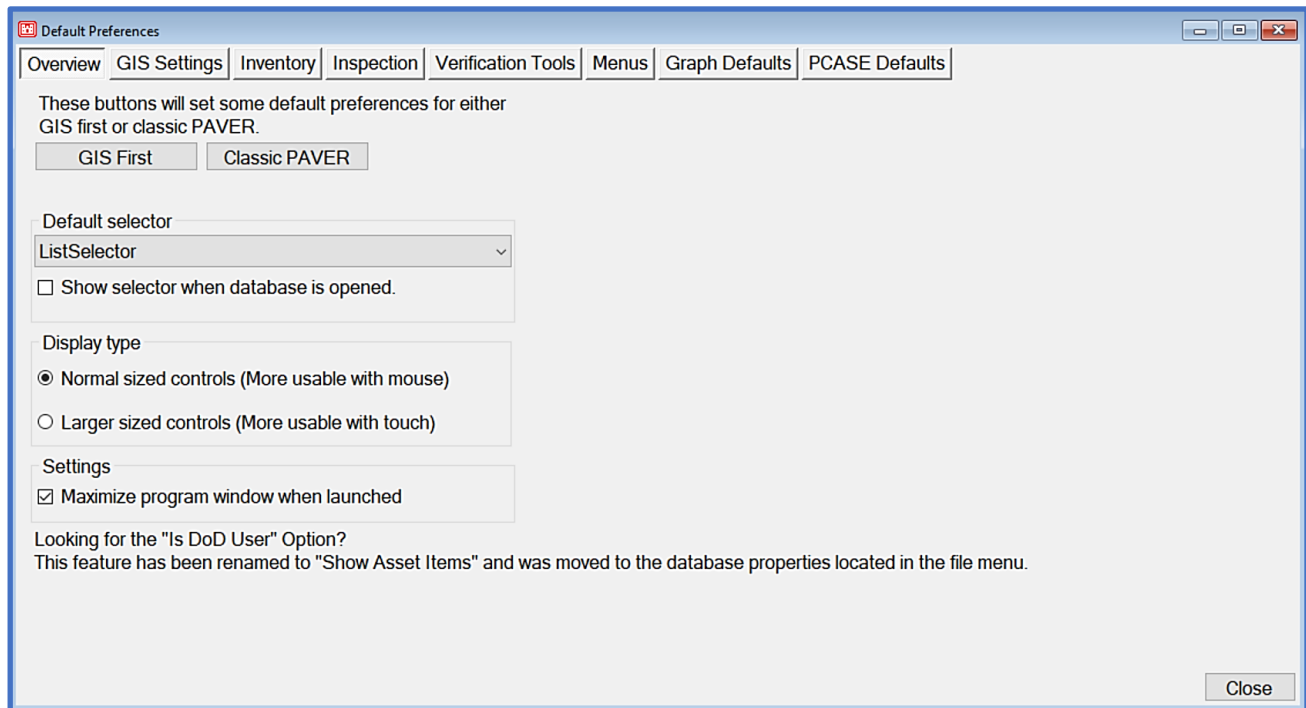
4.6 Defaults

The majority of the options within the **Default Preferences** form tabs contain default settings to control how certain aspects of the user interface are presented. In addition, **PCASE Defaults** offers preference options for Design and Evaluation criteria such as Moduli, Service, and analysis defaults for global application.

4.6.1 Overview

The **Overview** tab consists of options for displaying selectors and controls.

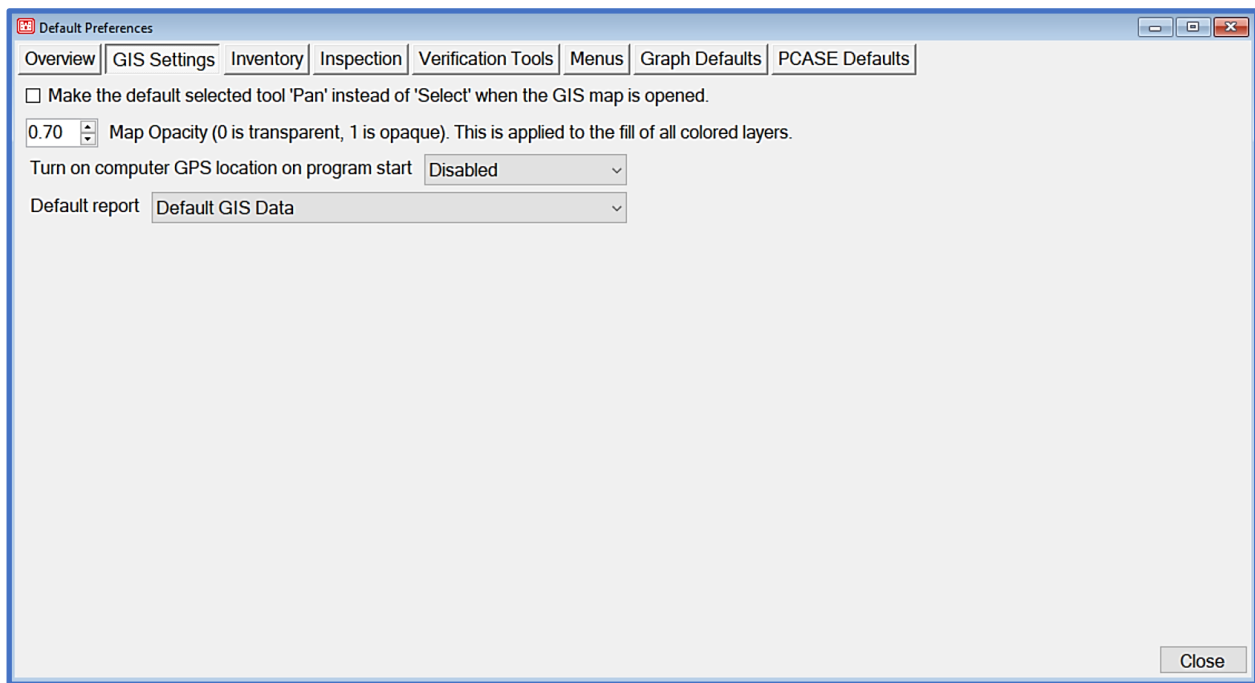
- **GIS First** will make **GIS Selector** the **Default selector**. Additionally, when PCASE 7 is restarted the **GIS Selector** and map will automatically open, if there is a **PAVER™** inventory in the current database. **Classic PAVER** reverts back to the **Default selector**, which is the **List Selector** and the next time PCASE 7 is opened the window will open as normal.
- The **Default selector** allows you to manually choose the selector that will open when using a selector is applicable within the program. Select the **Show selector when database is opened** checkbox if you would like the chosen selector to launch upon program start.
- The **Display type** options are useful for enlarging control visibility when in tablet mode on your computer.
- The main PCASE 7 program window opens slightly minimized by default. Select the **Maximize program window when launched** option if you would like the program to open with the main window maximized by default, the next time you open PCASE 7.



4.6.2 GIS Settings

The **GIS Settings** tab pertains to GIS map function defaults.

- The first option in this tab can be used to set the GIS map to pan when hovering over the map, meaning you can scroll over areas of the map without selecting sections/areas. You can override this default within the form to allow areas of a GIS map to be selected. Normally the GIS map is set to select by default.
- The next option allows you to control the level of opacity for colored layers within a GIS map. Lower the value to increase transparency or raise the value to increase opacity.
- GPS location is set to **Disabled** by default. Set this option to **Enabled** if you would like GPS to be turned on by default when the program is launched.
- The **Default report** option allows you to set a default report format from previously memorized **User Defined Reports**.



4.6.3 Inventory

The **Inventory** tab offers options to set default values for PAVER™ inventory Branches and Sections. These default values auto-populate during new Branch and Section creation.

Default Preferences

Overview | GIS Settings | Inventory | **Inspection** | Verification Tools | Menus | Graph Defaults | PCASE Defaults

New branch defaults

Branch ID: Branch Use: APRON ▾

New section defaults

Section ID: From: To:

Constructed: Length: Width:

Surface Type: AAC ▾ Rank: P ▾

Close

4.6.4 Inspection

The **Inspection** form options allow you to select how you would like PAVER™ Inspection form data to display for dates, distress entry, and quantity selection. This tab is only relevant if you have PAVER™ installed alongside PCASE 7.

Default Preferences

Overview | GIS Settings | Inventory | **Inspection** | Verification Tools | Menus | Graph Defaults | PCASE Defaults

New inspection defaults

☒ Use Today's Date ☐ Use Last Specified Date

Distress entry mode

☒ Old entry mode (will be removed in the future) ☐ New entry mode

Select quantity

% Quantity selector number of graduations

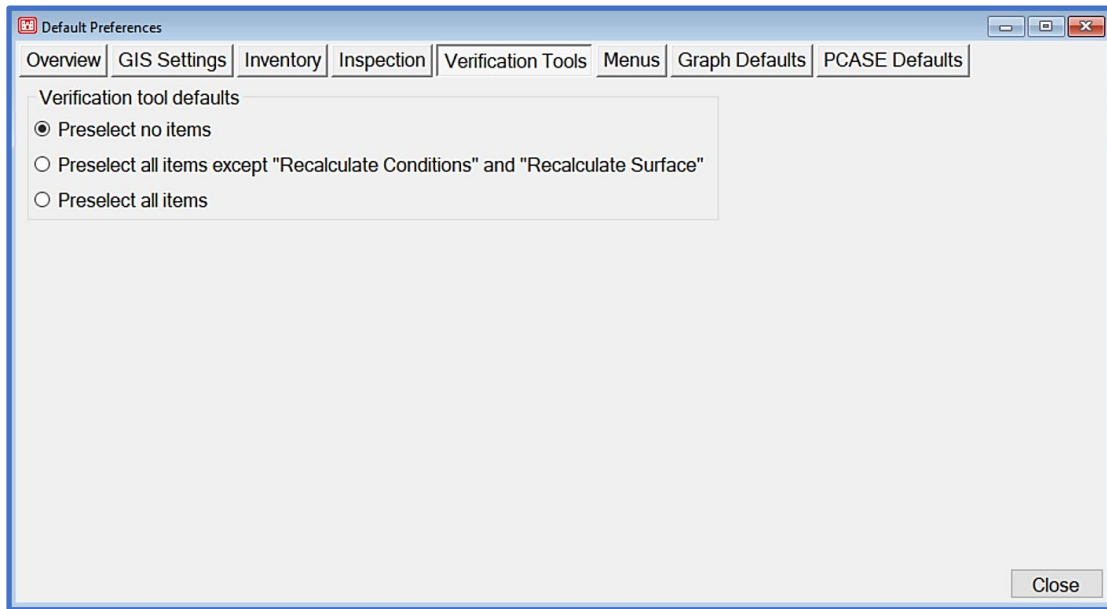
Default rigid sample distress entry type

☒ Grid ☐ List

Close

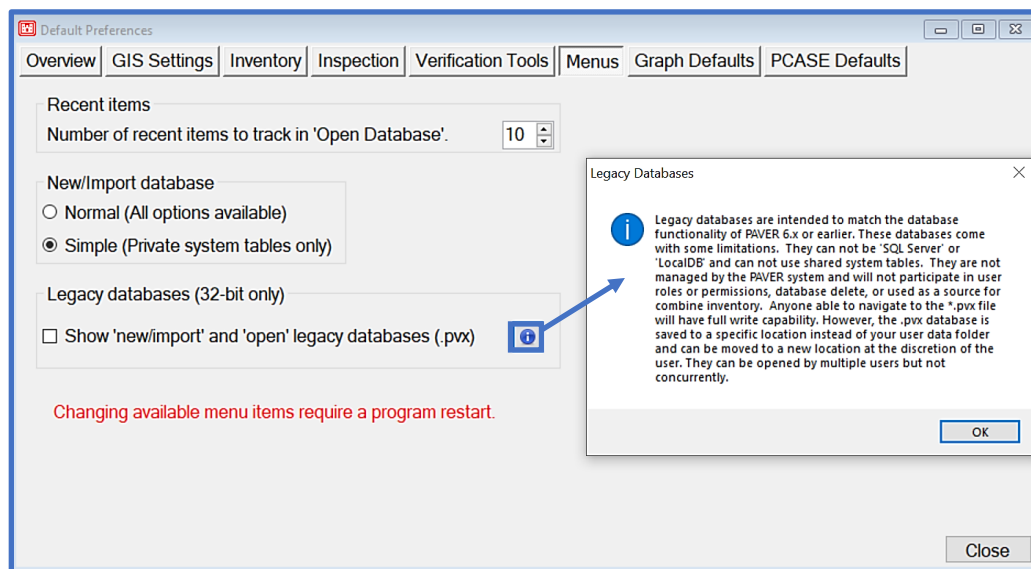
4.6.5 Verification Tools

The **Verification Tools** defaults pertain to PAVER™ Database Verification tools. These options are only relevant if you also have PAVER™ installed. When the Database Verification form opens some items are selected by default, you can use the **Verification Tools** tab to modify the default behavior for selection of items.



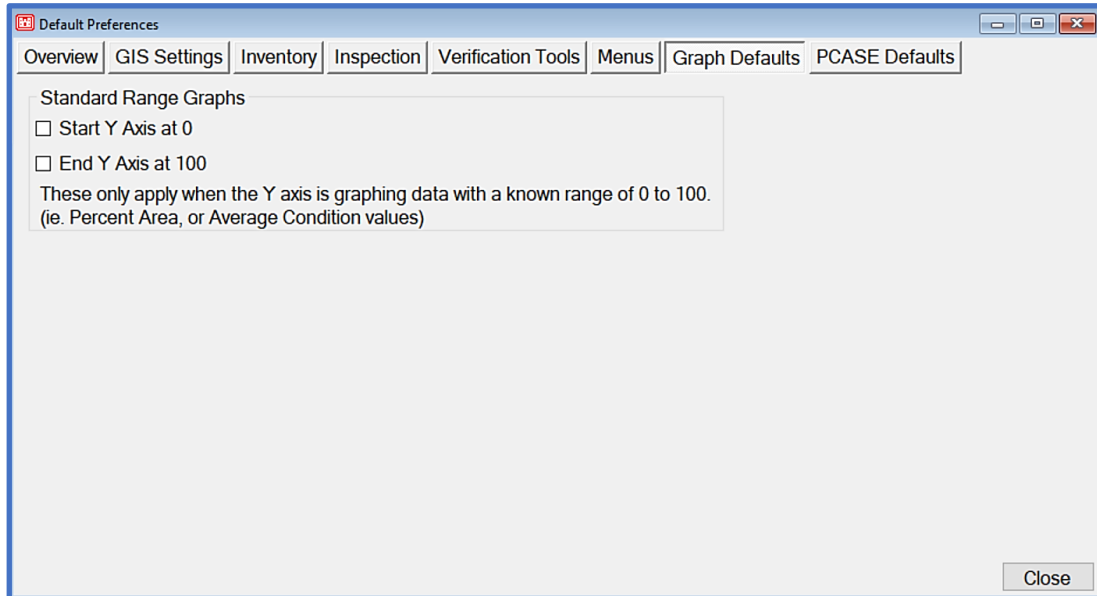
4.6.6 Menus

The **Menus** tab contains the two default database mode options; **Normal** or **Simple** modes. **Simple** mode is recommended for PCASE 7 users. Both of these options mainly impact how the database creation form is presented. The **File** menu options are also slightly different between the **Normal** and **Simple** modes. *Note: Changes made within this tab require a restart of PCASE 7 before they take effect.*



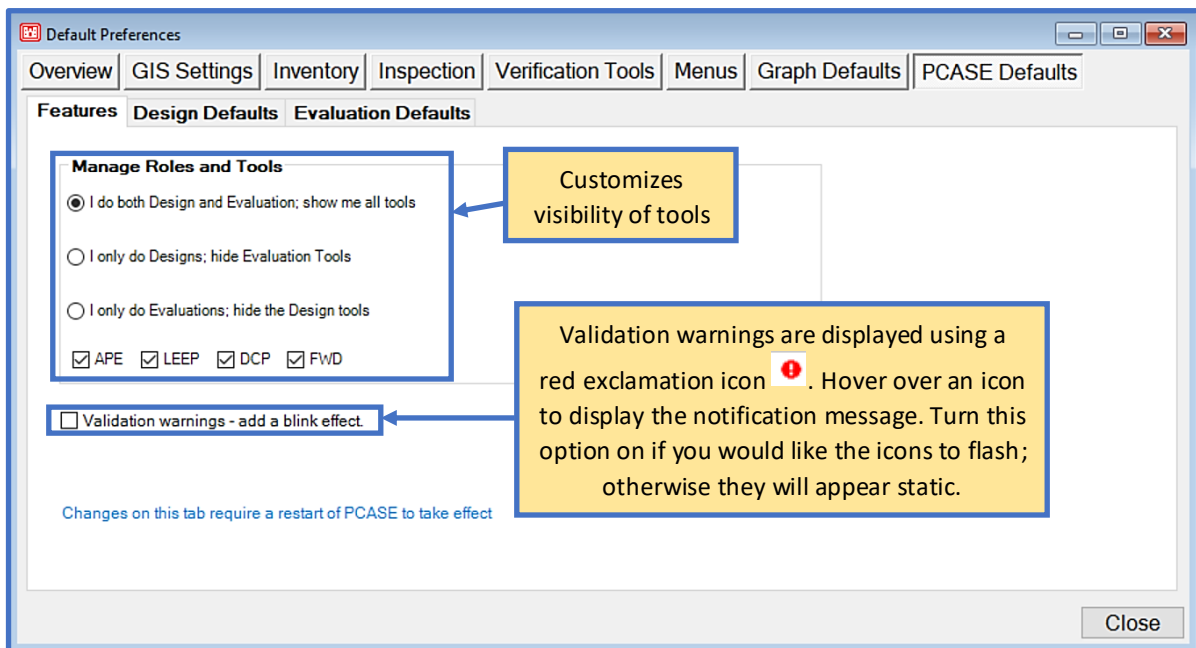
4.6.7 Graph Defaults

The **Graph Defaults** tab allows you to modify the Y-axis range for applicable graphs.



4.6.8 PCASE Defaults

The **PCASE Defaults** tab consists of three additional sub-tabs. The **Features** tab allows you to control visibility of Design and/or Evaluation tools, and the **Design Defaults** and **Evaluation Defaults** tabs contain module-specific default options. *Note: Changes made within this tab, require a restart of PCASE 7 to take effect.*



Default Preferences

Overview | GIS Settings | Inventory | Inspection | Verification Tools | Menus | Graph Defaults | PCASE Defaults

Design Defaults

Designer Name: _____

Default Service: Air Force

☐ Include Drainage Information ☐ Include Frost Information

Default Pavement Type: Airfield

Default Analysis Type: CBR/K

Default Failure SCI: 50

Default CBR Criteria: ☐ Alpha ☒ Beta-Alpha Hybrid

Default Subgrade Frost Code: F3F4

Default PCC Flex Strength: 650 psi

Default Moduli for Layer Types

Design Default Moduli

Layer Type	Default Modulus (psi)
Asphalt Concrete	200,000
Portland Cement Concrete	4,000,000
PCC Roller Compacted	4,000,000
Base	61,000
PCC Base Slab	4,000,000
AC Stabilized Base	200,000
PC Stabilized Base	2,000,000
Drainage	45,000
Separation	45,000
Subbase	24,000
Stabilized Subbase	44,000
Select Fill	24,000
Subbase Drainage	45,000
Subbase Separation	45,000
Modified Subgrade	24,000
Compacted Subgrade	24,000
Stabilized Subgrade	44,000
Natural Subgrade (Coarse)	9,000
Natural Subgrade (Fine)	15,000

Reset to Defaults OK Cancel

Design Defaults only apply to new design projects. Historical projects are not affected by changes.

Default moduli values are predetermined for each respective module. However, the default values can be overridden.

The default Rigid Failure Criteria is based on the selected Default Service and will update automatically when the Service is changed.

Changes made on the Evaluation Defaults tab only affect newly created evaluations. Historical evaluations imported from PCASE 2.09 will not inherit these attributes, unless a copy of the evaluation is made.

This setting is enabled on the Evaluation Manager form when Consider Frost is checked.

Evaluation Defaults

Shared APE/LEEP Defaults

☐ Open evaluation checklist with LEEP or APE

Default Service: Air Force Default Controlling Traffic Option: Calculate Controlling Vehicle

Default Traffic Pattern: C17 AT 50,000 PASSES

☐ Consider Frost ☐ Calculate Overlays

Default Cb: 0.8 Default subgrade frost code: F3F4

Percent damage occurring in thaw period: 25

Default Cr: 0.75

APE Defaults

APE Calculation Method: Layered Elastic for PCR using CBR to modulus correlation

Rigid Failure Criteria: Shattered Slab

Default PCC Flex Strength: 700 psi

PCR string evaluation code: 0 (Other)

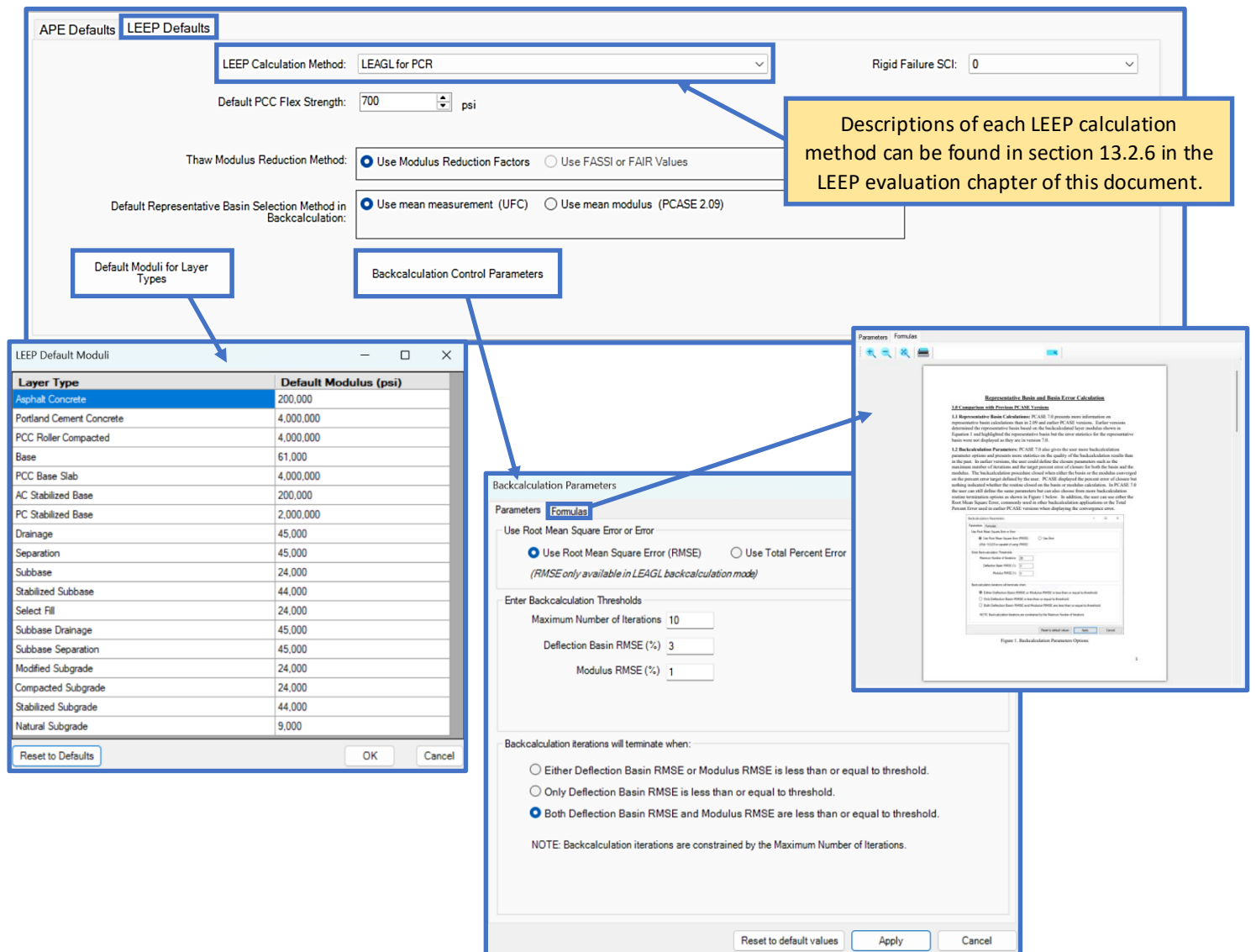
Default Moduli for Layer Types

APE Default Moduli

Layer Type	Default Modulus (psi)
Portland Cement Concrete	4,000,000
PCC Roller Compacted	4,000,000
PCC Base Slab	4,000,000
PC Stabilized Base	2,000,000

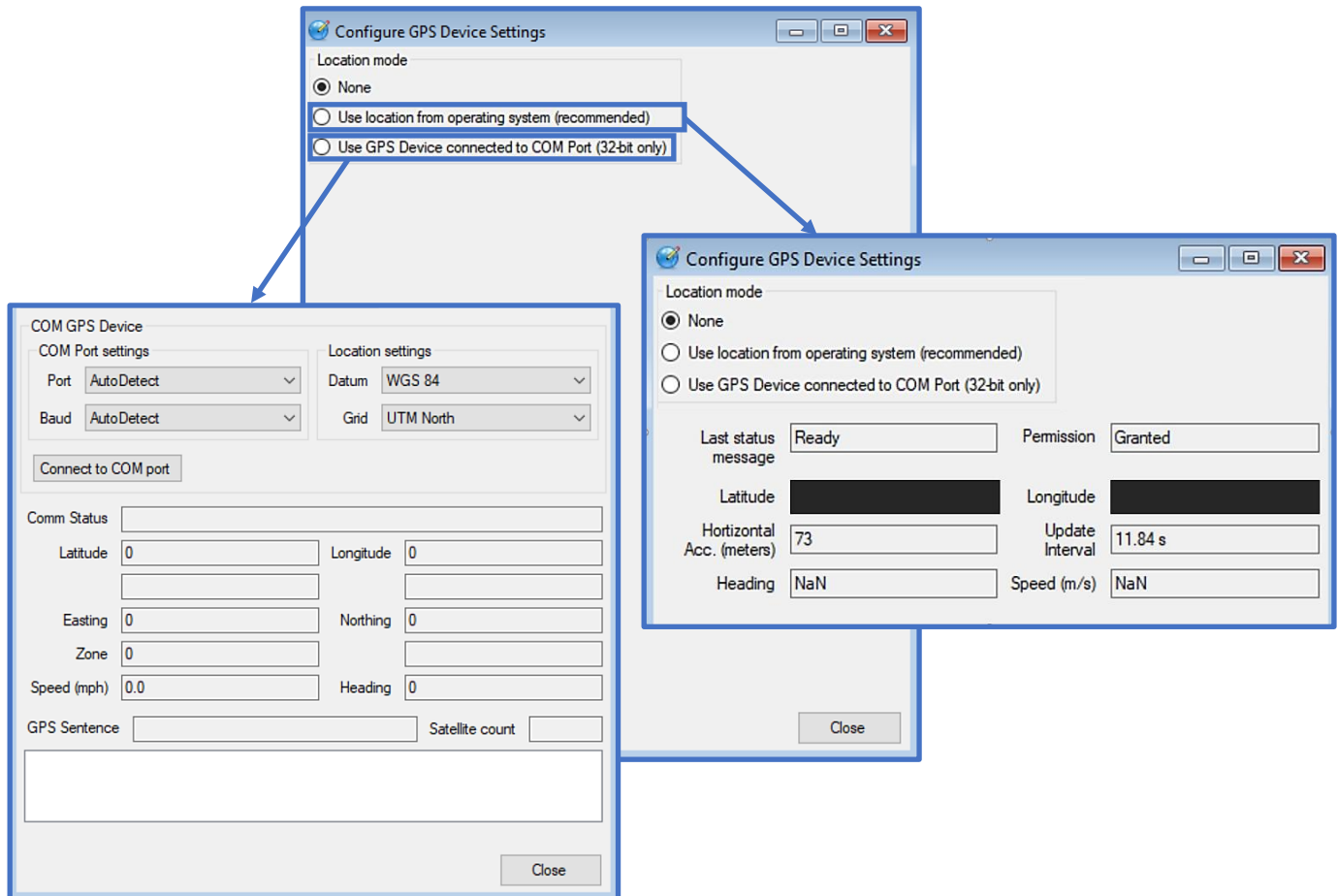
Reset to Defaults OK Cancel

Descriptions of each APE calculation method can be found in section 14.2.6 in the APE evaluation chapter of this document.



4.7 GPS Device

The **GPS Device** settings allow you to turn GPS on and off and configure how your GPS location is derived. The **None** radio button option is the default **Location mode** setting, meaning GPS is turned off by default. Selecting one of the other options will reveal your GPS status, according to the selected mode.

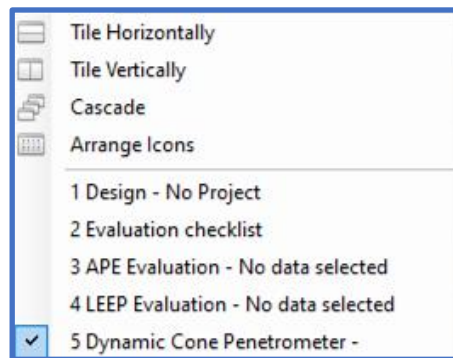


- **Use location from operating system (recommended):** In this mode, the Operating System attempts to coordinate between location providers to give the most accurate position. If the correct drivers are installed for your GPS device, this is the best mode to use. No configuration is required. This option works in both 32-bit and 64-bit modes. Windows will ask for permission to use your location information, if it doesn't already have permission. Permission must be granted in order for your location to be reported. When this option is enabled a horizontal accuracy (**Horizontal Acc. (meters)**) reading populates, if the number in this field is ≥ 75 meters then your GPS device probably isn't reporting location yet. After the GPS device locks on to satellites and starts reporting location, the accuracy radius will decrease; giving you a more accurate lock on your position. OS-level configuration of this setting can be found by searching for "Location privacy settings" in the control panel.

- **Use GPS Device connected to COM port:** This mode should only be used if your GPS device does not communicate with the OS. *Note: This option can only be used in 32-bit mode. Additionally, you may have to enter the **Port** and **Baud** rate manually in the **Com Port** settings.*

5 Window

The options within the **Window** menu allow you to adjust the manner in which each form is positioned in conjunction with other open forms. After you've selected one of these options, the lower portion of the menu will display an enumerated list of the forms that are currently open.



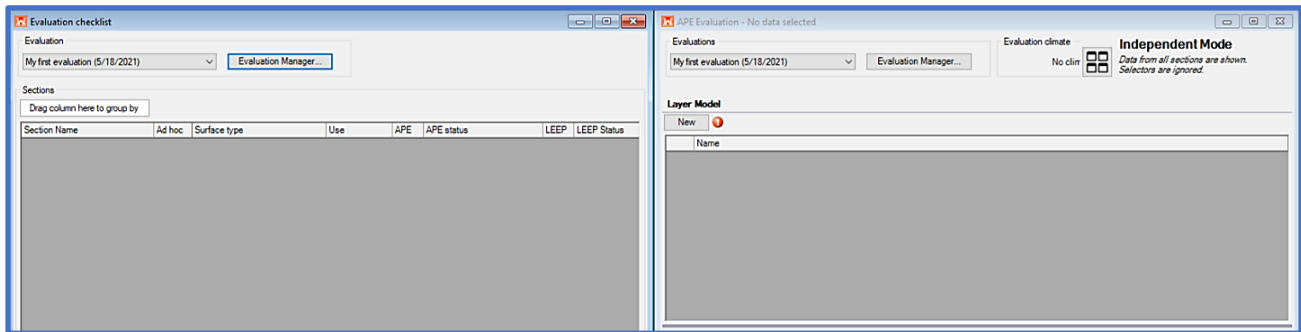
5.1 Tile Horizontally

If you opt to **Tile Horizontally**, any open form windows will become stacked in a horizontal manner.

The screenshot shows two application windows stacked horizontally. The top window is titled 'Evaluation checklist' and contains a dropdown menu for 'Evaluation' (set to 'My first evaluation (5/18/2021)'), an 'Evaluation Manager...' button, a 'Sections' section with a table header (Section Name, Ad hoc, Surface type, Use, APE, APE status, LEEP, LEEP Status), and buttons for 'Edit section properties', 'Refresh section properties', and 'Show inventory form'. The bottom window is titled 'APE Evaluation - No data selected' and contains a similar 'Evaluations' dropdown, an 'Evaluation Manager...' button, an 'Evaluation climate' section with a 'No climate selected' status, and a 'Layer Model' section with a 'New' button and a table header (Name).

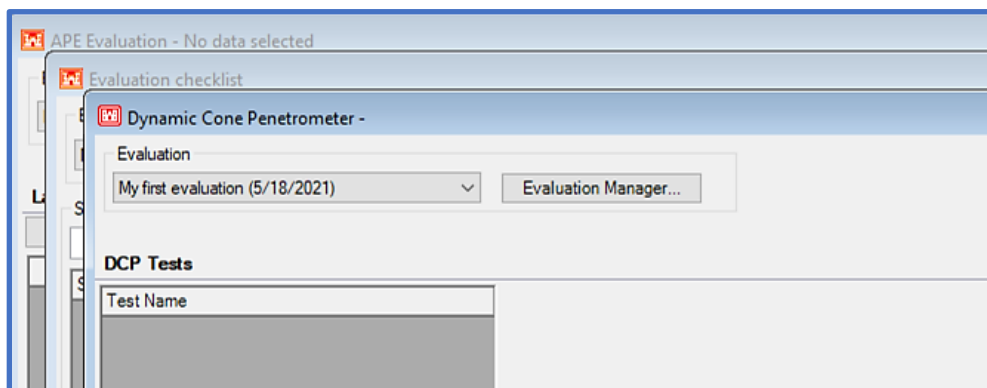
5.2 Tile Vertically

Tile Vertically works in the same manner as the **Tile Horizontally** option does, except the form windows will be situated next to each other in a vertical direction.



5.3 Cascade

Selecting the **Cascade** option will make any open forms display slightly staggered over each preceding form.



5.4 Arrange Icons

When open forms are minimized, the **Arrange Icons** option allows you to move around the minimized window icons at the bottom of the main PCASE 7 window.

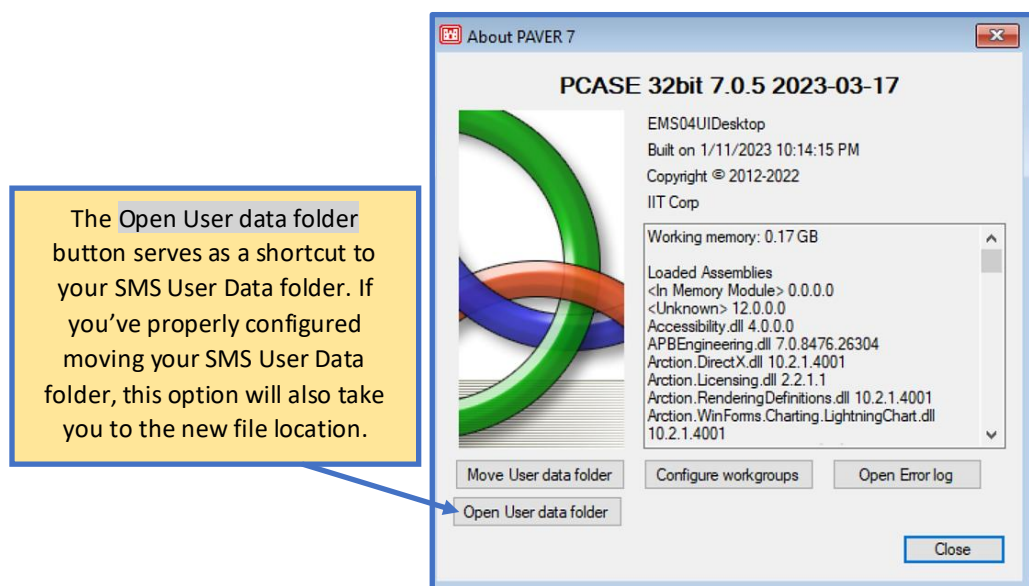


6 Help

The **Help** menu consists of the following options: **Program Version**, **Getting started with PCASE 7**, and **PCASE 7 User Guide**. **Program Version** contains information about the PCASE 7 version currently installed, you can also access your user data folder or error log from this window. **Getting started with PCASE 7** opens the pdf viewer that holds the library of help files for learning how to use the various modules within the program.

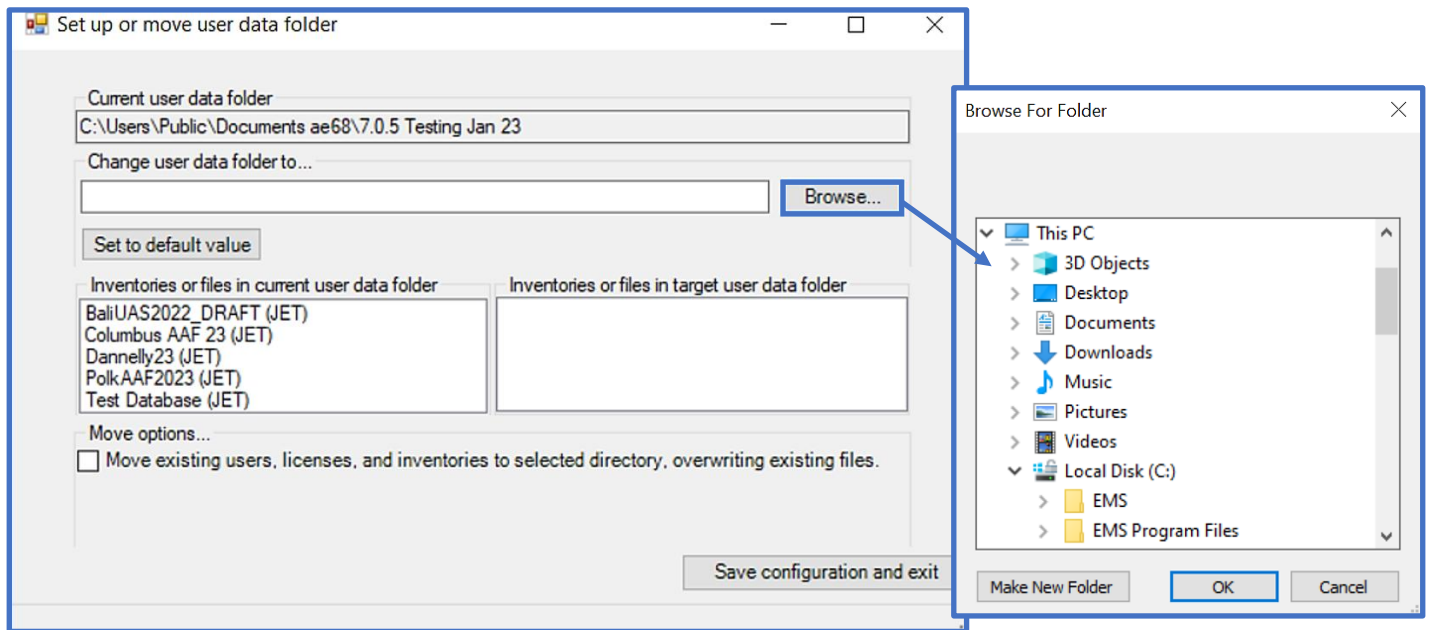
6.1 Program Version

The **Program Version** window contains information about the program build date and development information. You can also manage your user data folder and access your error log from this window.



6.1.1 Move User Data Folder

When PCASE 7 is installed on a computer for the first time, the SMS User Data folder is installed at the following default location: C:\Users\Public\Public Documents\SMS User Data. If you wish to move your SMS User Data folder to a different location, click on the **Move User data folder** button to begin the configuration process outside of PCASE 7. A confirmation message will pop-up, prompting you to continue. Once the **Set up or move user data folder** window has opened, you can **Browse** to the location you would like to move your SMS User Data folder to. You can also choose to create a new folder by clicking on the **Make New Folder** button. After you've chosen a new destination, click on the **Save configuration and exit** button. Further details can be found in [1.2.6 Installing the Software](#).



6.1.2 Open Error Log

If an error message is displayed while using the program, the notification message will suggest that you open your Error Log and/or share it with the development team. Selecting the **Open Error log** button will open a Windows Notepad window which contains detailed information about any program errors that occurred. To view the most recent error(s), scroll to the bottom of the window. Sharing this information with the PCASE development team can help pinpoint and resolve any found issues.

```

-----
Timestamp: 5/20/2021 12:43:10 PM
Message: Exception caught: ### BUILD DATE 4/27/2021 5:33:17 PM DLL VERSION 7.0.7810.22609 32-bit ###
Leap layerset
Exception.message: Object reference not set to an instance of an object.
@pc07UIevaluationITL.LEEPPlayersGrid.OnCellValueChanged(Object sender, DataGridViewCellEventArgs e) in \pc07UIevaluationITL\BindingHelpersLEEPGrids.c
@ SMS04AddIn.UI.DataGridViewHelper`2.mDataGridView_CellValueChanged(Object sender, DataGridViewCellEventArgs e) in \SMS04AddInUI\BindingBase.vb:line

Category: Error
-----

Timestamp: 5/20/2021 12:59:46 PM
Message: ### BUILD DATE 4/27/2021 5:33:17 PM DLL VERSION 7.0.7810.22609 32-bit ###
C:\Program Files\EMS\PCASE\resources
Category: Error
-----

```

6.2 Getting Started with PCASE 7

The **Getting Started with PCASE 7** pdf viewer contains a library of help files for quick reference to help you get started using the program; more detailed information and examples for each module can be found in the PCASE 7 User Guide.

The **PCASE Overview** tab includes files intended to help you become acclimated with the program. The **Create/Import a Database** file is positioned first because creating or importing a database is a fundamental first step before using PCASE 7. The **Key Features** document describes the various components used throughout the program. **Improvements to PCASE** highlights advancements made between PCASE versions (2.09-7) and **Calculation Differences** outlines known calculation differences between versions. The **PCASE Design Help** tab includes files to get you started using the **Design Module** and the **Design Traffic** form; which is accessible from the **Design Module**. The **PCASE Evaluation Help** tab includes files for each of the evaluation modules. **Define Inventory** provides instructions for creating an inventory to be used in the evaluation modules. The **Evaluation Checklist** can be used to manage section properties and also works as a selector in conjunction with the APE, LEEP, FWD, or DCP forms when they are set to **Selector Mode**. **Traffic for Evaluations** explains how to use the Traffic form that is accessible through APE and LEEP. The remaining help files provide module-specific guidance for APE, LEEP, DCP, and FWD Data.

The screenshot shows the 'Getting started with PCASE 7' help window. The window has three tabs: 'PCASE Overview', 'PCASE Design Help', and 'PCASE Evaluation Help'. The 'PCASE Overview' tab is active, showing a list of help files on the left and a detailed view of the 'Create/Import a Database' file on the right. Annotations with arrows point to various elements:

- Scroll down to view additional pages**: Points to the vertical scrollbar on the right side of the main content area.
- Type a word or phrase into the search field to quickly locate information**: Points to the search bar at the top of the left sidebar.
- Each Getting Started help file contains concise instructions to guide you through each specified module**: Points to the 'Create/Import a Database' file in the left sidebar.
- Open the selected pdf outside of the program with the default pdf viewer set on your computer to save or print a file. Click on the checkbox, then select a pdf.**: Points to the 'Open .pdf with default program' checkbox at the bottom of the window.
- Go back to the previously viewed file or continue to the next one**: Points to the 'Back' and 'Next' buttons at the bottom right of the window.

The main content area displays the 'Create/Import a Database' file. It includes a 'New/Import' section with a list of options: 'New/Import pavement database', 'GIS/Shapefile Import', 'GIS/Shapefile Import and Update', 'Export Open Pavement Database', 'Combine Inventory', 'Database Properties', 'Database Properties', 'Database Properties', 'Combine or Import PCASE 200 Data', and 'PCASE Data Assignment'. A callout box points to the 'New/Import pavement database' option, stating 'Simple available options'. Below this, the 'New/Import Pavement Database' section provides instructions for creating a new database or importing an existing one. It includes a list of steps: 1. Choose a Database properties option: Microsoft Access is the recommended default option suitable for most single user, standalone installs; Local DB and SQL Server are options for SQL Server users; both options support larger databases, and SQL Server supports multiple users. 2. If you opted for Microsoft Access, choose from the three radio buttons in the Initial Data field. A sub-step under step 2 states: 'Imported from e60, e65, e70 file enables import of a database with an .exs file extension; use this option if you have existing PAVERTM data. Select the Browse to File button to locate the file through your File Explorer. Once the file has been selected, the file path will populate in the form's Inventory import file field. Check the System tables created from defaults and appended with source data* checkbox, if applicable. Use the Inventory Name that populates automatically (if an .exs file was provided) or give the database a new name.'

6.3 PCASE 7 User Guide

Select **PCASE 7 User Guide** to open the user guide document directly from the program.

7 Inventory

The **Inventory** tools give you the ability to create and manage inventory data including pavement inventory, GIS data, and Asset management.

7.1 Define Inventory

The **Define Inventory** form provides tools to view, edit, and define pavement inventory. Prior to beginning an evaluation, it is essential to divide the pavement system into manageable Sections. Sections are based on common characteristics including pavement type, thickness, use, traffic type, soil layers, pavement condition, and construction history. A pavement inventory is essentially comprised of all pavement types, grouped by their function. If the currently open database contains a defined inventory, you can view or edit inventory details within the **Define Inventory** form. The same form can be used to create an inventory from scratch, by first defining a Network, then Branches and Sections within that Network. *Note: The **Define Inventory** form defaults to opening to the **Section** tab first.*

7.1.1 Network

Click on the **Network** tab if you wish to view or create a pavement inventory Network. If a Network does not already exist, click on the **New** button at the bottom of the window and the form will populate with fields. Each inventory should contain at least one Network. An inventory may also have additional Networks for closed, housing, or privatized pavements. For multiple Networks within the same database; add characters at the end of truncated names to make the distinction clear.

1. Edit the **Network ID** and **Network Name** fields. Use the following recommended naming convention:
 - **Network ID:** Based on site name (truncate to 10 characters).
 - **Network Name:** Site Name (limited to 60 characters).

1

Network ID: ColumbusAA

Network Name: Columbus Auxiliary Afield Site #1

Comments:

Use Camel Case (capitalize the first letter in each word without adding a space between words) to truncate the Network ID

The Network Name provides more information about the Network

You are editing: ☒ Current Values ☐ Historical Inspection Values

Images (0) New Copy Delete Close

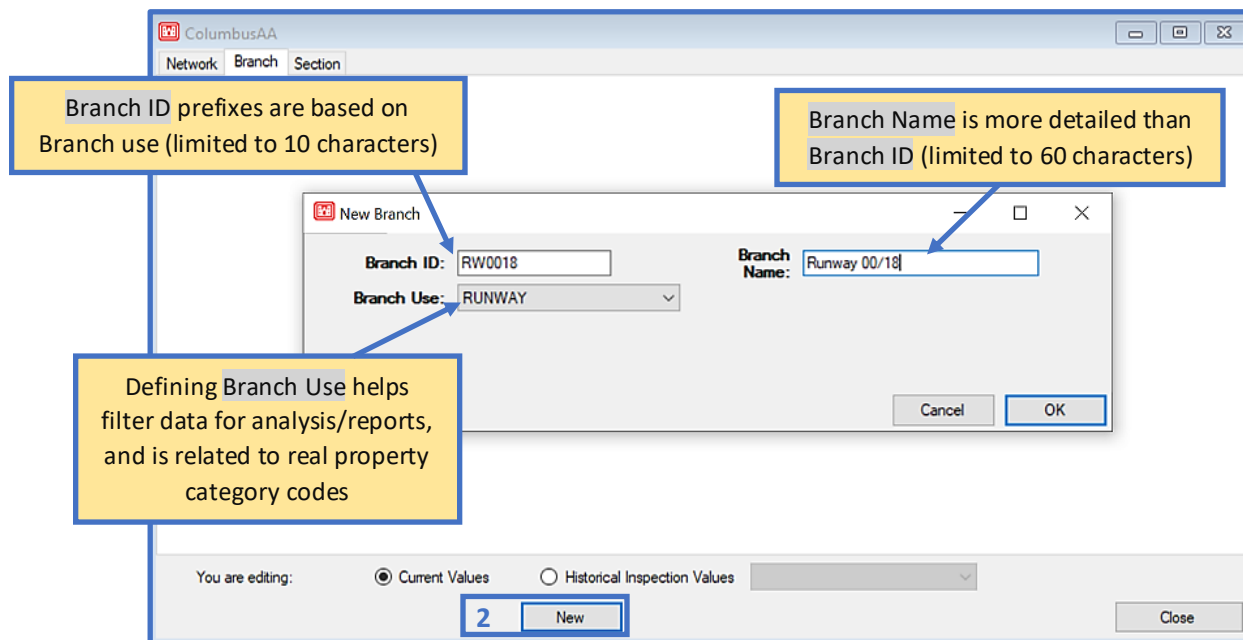
7.1.2 Branch

Branches are defined by pavement use. Examples of individual Branch segmentations are a runway, a named taxiway, a shoulder, a named road, or a contiguous parking area. See the tables below for further guidance on Branch identification.

Airfield Branch Identification	
Branch	Branch ID Example
RW = Runway	RW1028
TW = Taxiway	TWA
PA = Parking Apron	PAMain
AP = Other Apron	APMain
OA = Other Apron (AF)	OANWWARM
OR = Overrun	OR1028
HP = Helipad	HP1VTL
SH = Shoulder	SH1028

Road & Parking Branch Identification	
Branch	Branch ID Example
RD = Paved Road	The standard roadway Branch ID is the name of the road
UR = Unpaved Road	
PA = Paved Parking Area	
UP = Unpaved Parking Area	
DW = Paved Driveway	
UD = Unpaved Driveway	
MP = Motor Pool	
SA = Staging Area or Parade Deck	

2. To designate a Branch for a newly created Network select the **Branch** tab, then select **New** to populate fields for **Branch ID**, **Branch Name**, and **Branch Use**. Select **OK** once you've completed inputting Branch information. *Note: The same character restrictions that are enforced for **Network ID** and **Network Name** are also applied to **Branch ID** and **Branch Name**.*



7.1.3 Section

Each Branch is comprised of one or many Sections. Airfield Sections are defined by their physical characteristics and can be determined from imagery, UFC standards, pavement design, or construction records. Road and parking Sections must have the same pavement type and are assumed to be structurally similar; Sections are typically defined based on set intervals (eg., a break at an intersection). The tables below provide guidance for identifying airfield or roadway/parking Sections and their surface types.

Airfield Section Identification					
R = Runway T = Taxiway A = Apron H = Helipad O = Overrun S = Shoulder	+	Section number: Pavement grouped by similar pavement type/thickness, base type/thickness/strength, subgrade type/Strength, etc. Use: 01, 02, 03, ...99	+	A = Channelized traffic; full design weight B = Nonchannelized traffic; full design weight C = Nonchannelized traffic; traffic volume is low or 75% design weight D = Nonchannelized traffic; traffic volume is extremely low or 75% design weight, 1% of design passes	=
Example Section name: R01A					

Note: An airfield Section ID for a given installation is unique for that given installation.

Road & Parking Section Identification			
Branch Identification		Section Identification	
RD = Paved Road UR = Unpaved Road PA = Paved Parking Area UP = Unpaved Parking Area	+	Street Name Road Function Parking Lot Function Building Number	+
		Segment Section by: - Pavement Type - Pavement Rank - Change in Condition Use: 01, 02, 03, ...99	=
Example Section names: RD Falcon 01 PA 0300 01 UR Perimeter 03			

Pavement Surface Types

Abbreviation	Name	Distress Reference
AAC	Asphalt overlay over concrete	Asphalt
ABR	Asphalt over brick	Asphalt
AC	Asphalt concrete	Asphalt
ACT	Asphalt over cement treated base	Asphalt
APC	Asphalt overlay over Portland cement concrete	Asphalt
APZ	Asphalt over pozzolanic base	Asphalt
BR	Brick	Asphalt
COB	Cobblestone	Asphalt
GR	Gravel	Unsurfaced
MAT	Matting	Unsurfaced
PCC	Portland cement concrete	Concrete
PVB	Paving blocks	Asphalt
SS	Stabilized surface	Unsurfaced
ST	Surface treatment	Asphalt
X	Other	Asphalt

3. Select the **Section** tab, then the **New** button to begin adding Section data.

See below for detailed information on defining Section Rank.

3

The Slab Data section is only displayed for PCC Surface Type

Airfield Section Rank		
Rank	Code	Description
Primary	P	Primary pavements are mission-essential pavements such as runways, parallel taxiways, main parking aprons, arm-disarm pads, alert aircraft pavements, and overruns (when used as a taxiway or for takeoff). In general, only pavements that have aircraft use on a daily basis or frequently used transient taxiways and parking areas are considered primary
Secondary	S	Secondary pavements are mission-essential but occasional-use airfield pavements, including ladder taxiways, infrequently used transient taxiway and parking areas, overflow parking areas, and overruns (when there is an aircraft arresting system present). In general, any pavements that do not have daily use by aircraft are secondary
Tertiary	T	Tertiary pavements include pavements used by towed or light aircraft, such as maintenance hangar access aprons, aero club parking, wash racks, and overruns (when not used as a taxiway or to test aircraft arresting gear). Paved shoulders are classified as tertiary. In general, any pavement that does not support aircraft taxiing under their own power or is used only intermittently is considered a tertiary pavement.
Unused	U	Unused pavements include any pavements that are abandoned (not maintained) or scheduled for demolition.

Road and Parking Section Rank		
Rank	Code	Description
Primary	P	Primary pavements include installation roads and streets that serve as the main distributing arteries (arterials) for traffic originating outside or within an installation. These pavements have high traffic volumes and speeds of 35 to 55 mph but may include collector or local streets that service mission critical facilities. Classification of vehicle parking areas as primary pavements should be restricted to those areas associated with access to mission-essential facilities, such as alert facilities, munitions facilities, and medical facilities.
Secondary	S	Secondary pavements include collector streets that gather and disperse traffic between arterials and local streets. They will have lower traffic volumes than primary pavements and speeds of 25 to 40 mph. Most parking areas that support daily traffic on a base are considered secondary pavements, unless a specific mission dictates otherwise.
Tertiary	T	Tertiary pavements include local streets that provide access from collector roads to individual facilities. Unsurfaced roads are also typically classified as tertiary. Any parking area that is not used on a daily basis or is excess to the standard facilities requirements is considered a tertiary pavement.
Unused	U	Unused pavements include any pavements that are abandoned (not maintained) or scheduled for demolition.

4. The **Section** tab contains additional fields for calculating area. The **Calculated Area** is a product of the Section's user-entered **Length** and **Width** and cannot be edited. Decreases in Section area (resulting from items like cutouts) should be entered as negative values. **Calculated Area** and **Area Adjustment** are totaled to obtain the **True Area** displayed (the value used in PCASE 7 calculations and reports). The **True Area** field can be edited directly if the true area of a Section is known, then PCASE 7 will calculate the **Area Adjustment** automatically. Area adjustments can also be made at the Branch-level.

The formula for calculating **Total Slabs** is based on the sections **True Area** and the average **Slab Length** and **Slab Width**. See below.

$$Total\ Slabs = \frac{True\ Area}{Slab\ Length \times Slab\ Width}$$

$$Total\ Slabs = \frac{11,200}{20 \times 14} = 40\ Slabs$$

The formula for calculating **Joint Length** is based on the average **Slab Length** and **Slab Width**, along with the dimensions of the Section. The formula used for **Joint Length** is shown below.

$$\text{Joint Length} = \left[\left(\frac{\text{Section Length}}{\text{Slab Length}} \right) - 1 \right] \times \text{Section Width} + \left[\left(\frac{\text{Section Width}}{\text{Slab Width}} \right) - 1 \right] \times \text{Section Length}$$

*Note: Calculated values for **Joint Length** and/ or **Total Slabs** can be overridden.*

The screenshot displays the 'Shuqual:APPARK::A01B' window. It includes tabs for 'Network', 'Branch', and 'Section'. The 'Section' tab is active, showing fields for 'Section ID' (A01B), 'From' (00), 'To' (00), 'Surface Type' (PCC), 'Rank' (S), 'Last Construction Date' (1/1/1959), and 'FOD Aircraft' (F-16). A checkbox for 'Date was back calculated' is present. Below these are 'Length' (260.00), 'Width' (100.00), and 'Calculated Area' (26,000.00). A 'Calculate' section has radio buttons for 'Area Adjustment' (selected) and 'True Area'. 'Slab Data' includes 'Slab Length (Typical)' (12.50), 'Slab Width' (15.00), 'Total Slabs' (144), and 'Joint Length' (3,453.3). A 'Comments' box and 'Assign Asset Items'/'Show Asset Data' buttons are also visible. On the right, a 'Descriptive Fields' table lists 'Grade', 'Lanes', 'Category', 'Shoulder', 'StreetType', and 'Zone'. At the bottom, there are radio buttons for 'Current Values' (selected) and 'Historical Inspection Values', along with a 'New' button and a 'Delete' button. A 'Close' button is in the bottom right corner.

Descriptive Fields	User Defined Fields
Grade	0
Lanes	0
Category	
Shoulder	
StreetType	
Zone	

Go to System
Tables and Tools
> Edit Inventory
Picklists >
Descriptive
Fields to
manage fields.

4

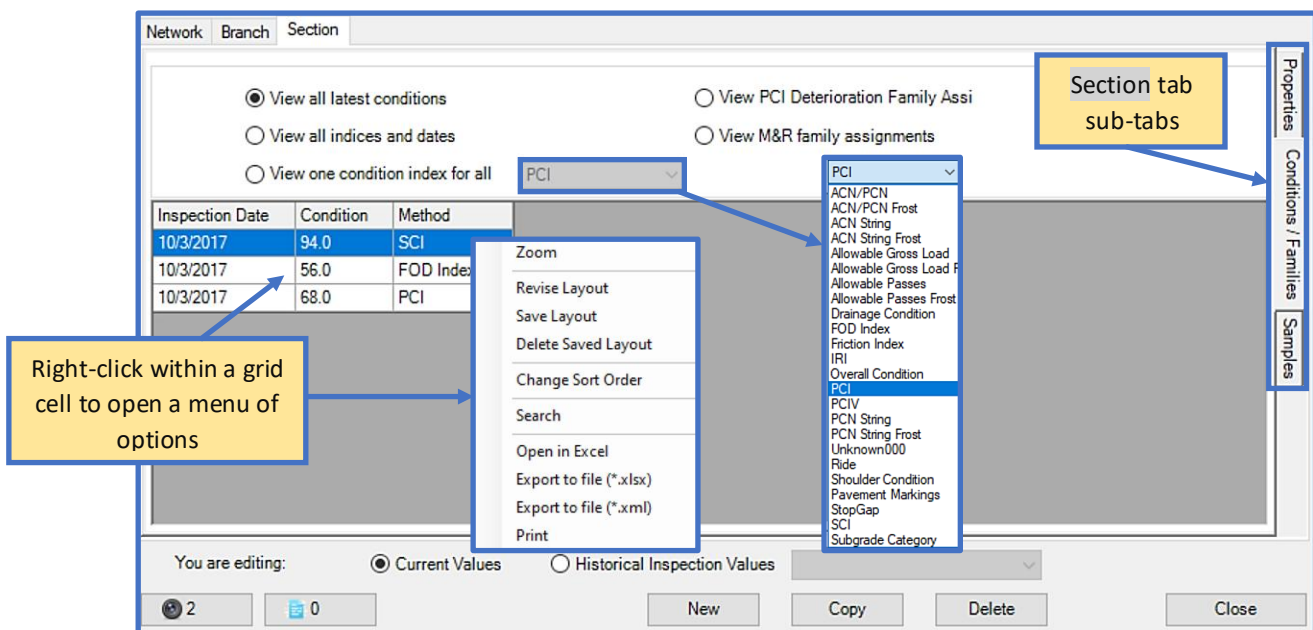
The number of images assigned to a Section are displayed within the Image Viewer button.

Historical Inspection Values signifies that the values being displayed are from previous inspection data. Selecting this option invokes a drop-down list of historic inspection dates from the database. Once a date range has been chosen, the associated data will populate in the form fields.

7.1.4 Condition/Families

The **Conditions/Families** Section sub-tab offers a convenient way to view conditions associated with all construction and inspection dates and family assignment data.

- **View all latest conditions:** Displays a table with the last computed/inputted condition indices associated with the selected Section.
- **View all indices and dates:** A complete listing of every condition index for every date occurrence listed within the Section history.
- **View one condition index for all dates:** Shows all dates for each selected index. After selecting this option, the drop-list of condition indices will activate.
- **View PCI Deterioration Family Assignments:** Displays Family assignment data for the selected Section. You can also change the Family assignment with this option.
- **View M & R family assignments:** A table displays M &R Family types and Family names for the selected Section.



7.1.5 Samples

Samples can be added or deleted at the Section-level using the **Samples** sub-tab. Selecting **New Sample** creates a new row where you can edit the default **Sample Number**, **Sample Size**, and **Comments** fields. To delete a Sample, highlight the Sample row, then click on **Delete Sample**.

The screenshot displays the 'Samples' sub-tab within a software application. The main area contains a table with the following data:

Sample Number	Sample size	Size units	Comments
001	200.00	SqFt	
002	500.00	SqFt	

Below the table are two buttons: 'New Sample' and 'Delete Sample'. At the bottom of the window, there are radio buttons for 'You are editing:' with 'Current Values' selected and 'Historical Inspection Values' unselected. To the right of these are 'New', 'Copy', 'Delete', and 'Close' buttons. A yellow callout box on the right points to the 'Samples' sub-tab in the right-hand pane.

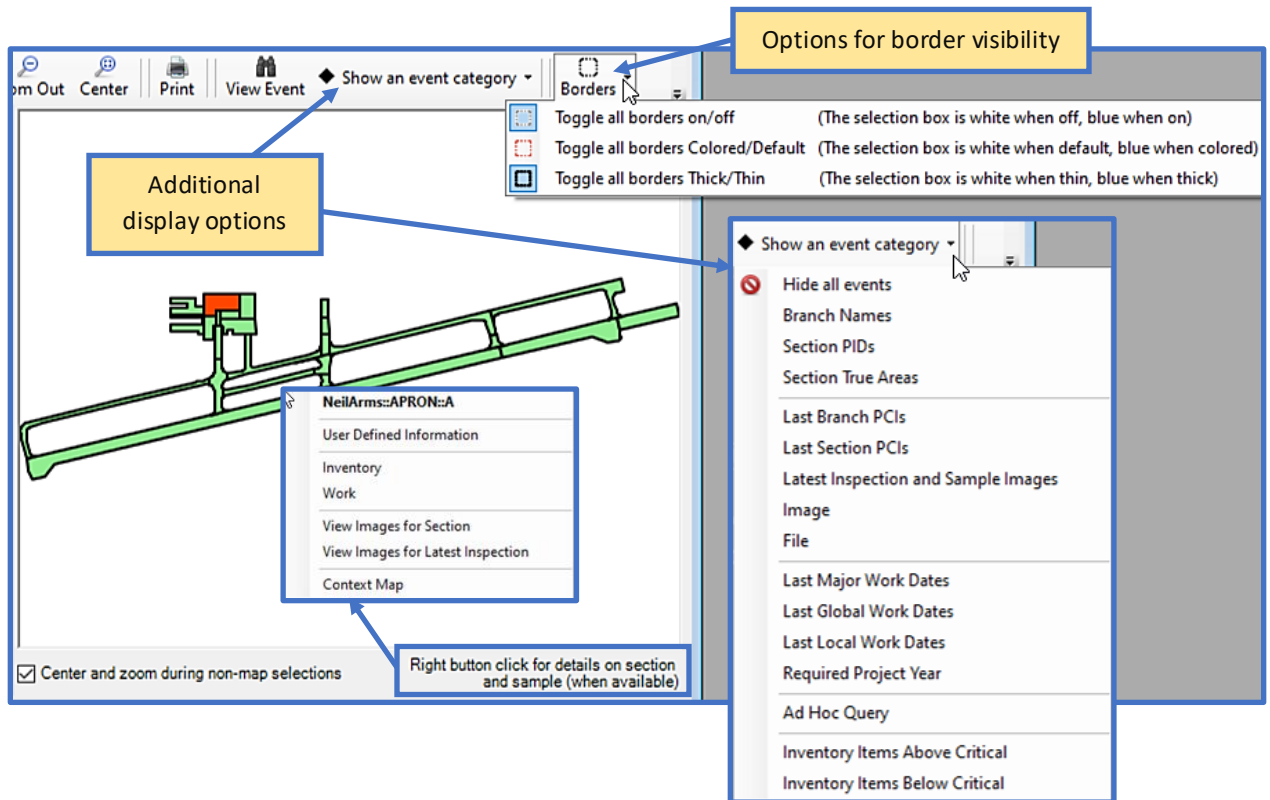
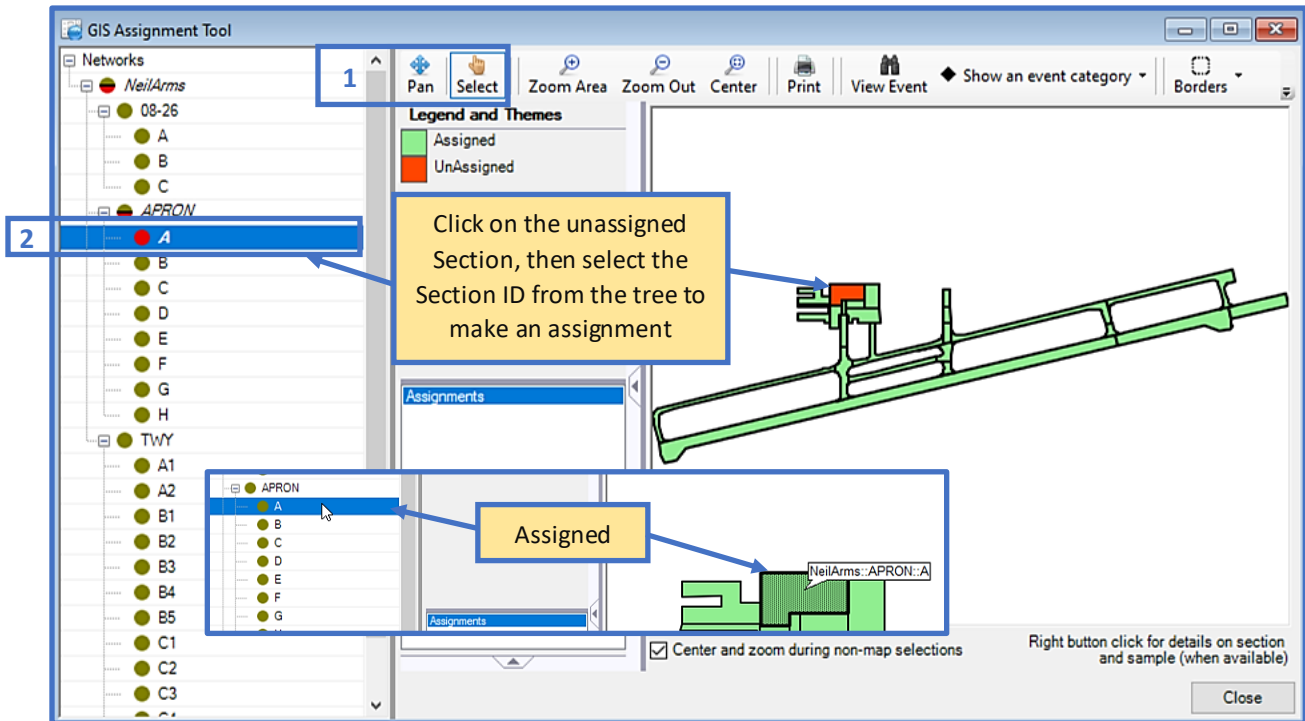
7.2 GIS Assignment

The **GIS Assignment** tool links Sections to GIS data, and allows you to create, remove, or modify the link between pavement inventory Sections and map features.

If GIS data has already been linked to Sections within the database; a tree selector list of the inventory and corresponding GIS map will populate. *Note: The **GIS Assignment** tool option will be disabled if the current database does not contain GIS data.*

1. The **GIS Assignment Tool** form opens in **Select** mode by default. If you wish to only view GIS data and not make Section assignment changes, switch to **Pan** mode.
2. Unassigned inventory Sections and GIS data will be colored red in the tree, and within the GIS map. To make an assignment, select an unassigned shape from the GIS map then select the Section ID in the tree. When the assignment has been completed, the Section ID and the map shape will be colored green.

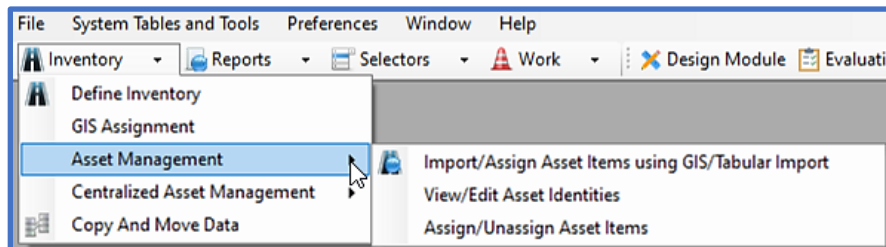
To unassign a Section within the GIS map, double-click on the Section in the GIS map.



7.3 Asset Management

The Asset Management tools allow you to view an inventory through an Asset Management perspective. Assigning Assets to an inventory creates an association between the pavement inventory and the Real Property inventory. Additionally, once this link has been established, reporting tools can be ran using Asset parameters. Asset items can be imported into PCASE 7 using the Import/Assign Asset Items using GIS/Tabular Import tool; where you can view and/or edit Asset identities and make assignments.

Note: In order to use these tools, turn on Show Asset Items under File > Database Properties > Preferences. Once Show Asset Items has been enabled, the tool options will appear beneath the GIS Assignment tool.



7.3.1 Import/Assign Asset Items using GIS/Tabular Import

The Import/Assign Asset Items form is modelled after the GIS/Tabular Import form, and follows a similar workflow. First select a file type to import within the Inventory Data File to Import group, then Browse to the Asset data file location on your computer. Once you've selected a file, the file path will populate in the field next to the Browse button. Select the Assign Imported Items checkbox if you wish to assign the imported Asset data, and choose an Update Level option. After the required fields have been satisfied the Next button will enable so that you may continue to the next few steps. Options for assigning Asset items will follow once the import process has been completed. For more information on assigning Asset items, refer to [Section 7.3.2](#).

Import/Assign Asset Items

Inventory Data File to Import

☒ GIS Shapefile
 ☐ Excel Spreadsheet
 ☐ CSV Comma Separated Values

H:\PAVER\PAVER Reference\GIS_Tabular Data\InventoryMaps - R Campbell- Tigerbrain\2018_FTC_Sections_05252018.shp Browse

☒ Assign Imported Items

CATCD Type: Amy

Update Level

☐ Branch
 ☒ Branch and Section

Destination Inventory Database

Test Database

Show template file
Cancel
< Back
Next >
Finish

Opens an Excel spreadsheet template which shows the required column format for import

Click on the Next button to proceed to the next form

Import/Assign Asset Items

Assignment Target Fields

Network ID: NETWORKID
 Branch ID: BRANCHID
 Section ID: SECTIONID

Branch Linear Segmentation

CAT Code: CATCD
 RPSUID: RPSUID
 Site Name: SITEID

RPUID: RPUID
 Facility ID: FACILID
 Facility Name: FACILNM

Dominant Facility CAT Code:

Section Linear Segmentation

CAT Code: CATCD
 RPSUID: RPSUID
 Site Name: SITEID

RPUID: RPUID
 Facility ID: FACILID
 Facility Name: FACILNM

Dominant Facility CAT Code:

*Mandatory fields identify items to modify and cannot be changed

Show template file
Cancel
< Back
Next >
Finish

Proceed to the next form to validate items, unless you would like to make changes to the above fields.

7.3.2 View/Edit Asset Identities

Assets can be created and edited individually in the system tables using the **View/Edit Asset Identities** tool. The **Add** button creates a new row within the tab you currently have open so that you can enter information directly in the grid. The **Delete** button will display when the selected row can be deleted – information that is currently in use within the database cannot be deleted. Assignments can also be undone by selecting a row, then the **Clear assignments to selected item** button.

The screenshot shows a software window titled "Descriptive Inventory Droplists". At the top, there are several tabs labeled: "1) Zone", "2) Section Category", "3) Shoulder", "4) Street Type", "5) FAC", "6) CATCD", "7) Site", "8) Facility", and "9) Manage Descriptive Fields". The "8) Facility" tab is currently selected. Below the tabs is a table with the following columns: "Facility ID", "Facility Name", "RPUID", "RPSUID - Site", "Dominant Fac", and "Sort Order". The table contains 20 rows of data, each representing a different facility. The first row is highlighted in blue. At the bottom of the window, there are four buttons: "Clear assignments to selected item", "Close", "Add", and "(In use)".

Facility ID	Facility Name	RPUID	RPSUID - Site	Dominant Fac	Sort Order
NFA1000000	TAXIWAY J (ON R/W 14) TO CALA	21159	1 - MCAS CH	11210	Alpha
NFA1000000	VTOL LANDING PAD (KILO TAXIWAY)	22161	1 - MCAS CH	11125	Alpha
NFA1000000	COMBAT AC LOAD AREA	20639	1 - MCAS CH	11656	Alpha
NFA1000000	AIRFIELD PAVEMENTS-TAXIWAY #1	17993	1 - MCAS CH	11210	Alpha
NFA1000000	FIVE REFUEL THRU LN BY TAXIWAY	20030	1 - MCAS CH	11210	Alpha
NFA1000000	ACCESS APRON HANGAR 1700	20040	1 - MCAS CH	11340	Alpha
NFA1000000	AC WASHRACK PAVEMENT (FAC)	20939	1 - MCAS CH	11610	Alpha
NFA1000000	RUNWAY 14L	22022	1 - MCAS CH	11110	Alpha
NFA1000000	ACFT WASHRACK BY 1700	18576	1 - MCAS CH	11610	Alpha
NFA1000000	RUNWAY 32L	22025	1 - MCAS CH	11110	Alpha
NFA1000000	FOUR REFUEL THRU LANE TW A	20031	1 - MCAS CH	11210	Alpha
NFA1000000	TAXIWAY BTWN R/W 19&23(OLD 1)	20035	1 - MCAS CH	11210	Alpha
NFA1000000	TAXIWAY E (ECHO)	20027	1 - MCAS CH	11210	Alpha
NFA1000000	VTOL LANDING PAD (NE R/W32)	18443	1 - MCAS CH	11125	Alpha
NFA1000000	WARMUP PAD NO1 BY HUB	20042	1 - MCAS CH	11642	Alpha
NFA1000000	TAXIWAY NO. 3 INNER	21840	1 - MCAS CH	11210	Alpha
NFA1000000	ACCESS APRON HANGAR 1665-1	20039	1 - MCAS CH	11340	Alpha

7.3.3 Assign/Unassign Asset Items

The Asset assignment tool is comprised of three tabs and a **List Selector**, which launches with the assignment tool to make searching for selections easier. The first tab, **Asset Inventory Items**, provides options to assign Asset items.

View or edit Asset identities

Select the row you would like to assign, then an assignment level

RPUID	Facility ID	Facility Name	Dominant Facility CAT Code	RPSUID	Site Name
21159	NFA10000087443	TAXIWAY J (ON R/W 14) TO CALA	11210	1	MCAS CHERRY POINT MAIN BASE
22161	NFA10000086408	VTOL LANDING PAD (KILO TAXIWAY)	11125	1	MCAS CHERRY POINT MAIN BASE
20639	NFA10000085016	COMBAT AC LOAD AREA	11656	1	MCAS CHERRY POINT MAIN BASE
17993	NFA10000063968	AIRFLD PAVEMENTS-TAXIWAY #19	11210	1	MCAS CHERRY POINT MAIN BASE
20030	NFA10000082518	FIVE REFUEL THRU LN BY TAXIWAY H	11210	1	MCAS CHERRY POINT MAIN BASE
20040	NFA10000082616	ACCESS APRON HANGAR 1700	11340	1	MCAS CHERRY POINT MAIN BASE
20939	NFA10000083492	AC WASHRACK PAVEMENT (FAC 1701)	11610	1	MCAS CHERRY POINT MAIN BASE
22022	NFA10000063664	RUNWAY 14L	11110	1	MCAS CHERRY POINT MAIN BASE
18576	NFA10000078499	ACFT WASHRACK BY 1700	11610	1	MCAS CHERRY POINT MAIN BASE

Filter Grid - Filter rows in the selections grid allowing for easier selection.

Field	Value
RPUID	
Facility ID	
Facility Name	
Dominant Facility CAT Code	
RPSUID	
Site Name	

The next tab, **Asset Use Category**, allows you to assign Asset types based on pavement use

Assign Asset Categories to Branches using Identity Asset Items

CAT Code Type	FAC	FAC Title	CAT Code	CAT Code Title
Navy	1111	FIXED WING RUNWAY, SURFACED	11110	RUNWAY/FIXED-WING - SURFACED
Navy	1111	FIXED WING RUNWAY, SURFACED	11125	FIXED-WING AIRCRAFT (VTOL) LANDING PAD
Navy	1112	ROTARY WING LANDING AREA	11115	RUNWAY ROTARY-WING
Navy	1112	ROTARY WING LANDING AREA	11120	HELICOPTER LANDING PAD
Navy	1113	RUNWAY OVERRUN AREA, SURFACED	11130	RUNWAY OVERRUN - PAVED SURFACED
Navy	1114	RUNWAY, UNSURFACED	11112	RUNWAY/FIXED-WING-UNSURFACED
Navy	1121	TAXIWAY, SURFACED	11210	TAXIWAY
Navy	1131	AIRCRAFT APRON, SURFACED	11320	AIRCRAFT PARKING-APRON
Navy	1131	AIRCRAFT APRON, SURFACED	11340	AIRCRAFT ACCESS-APRON
Navy	1131	AIRCRAFT APRON, SURFACED	11635	ARMING AND DE-ARMING PAD
Navy	1131	AIRCRAFT APRON, SURFACED	11650	TOWWAY

Filter Grid - Filter rows in the selections grid allowing for easier selection.

Field	Value
CAT Code Type	
FAC	
FAC Title	
CAT Code	
CAT Code Title	

The last tab, **Clear Item Assignments**, gives you the ability to clear Asset item assignments. Select a row, then the **Clear Assignments to Selected Item** button to clear a single assignment. If you wish to remove all assignments, select the **Clear All Assignments** button.

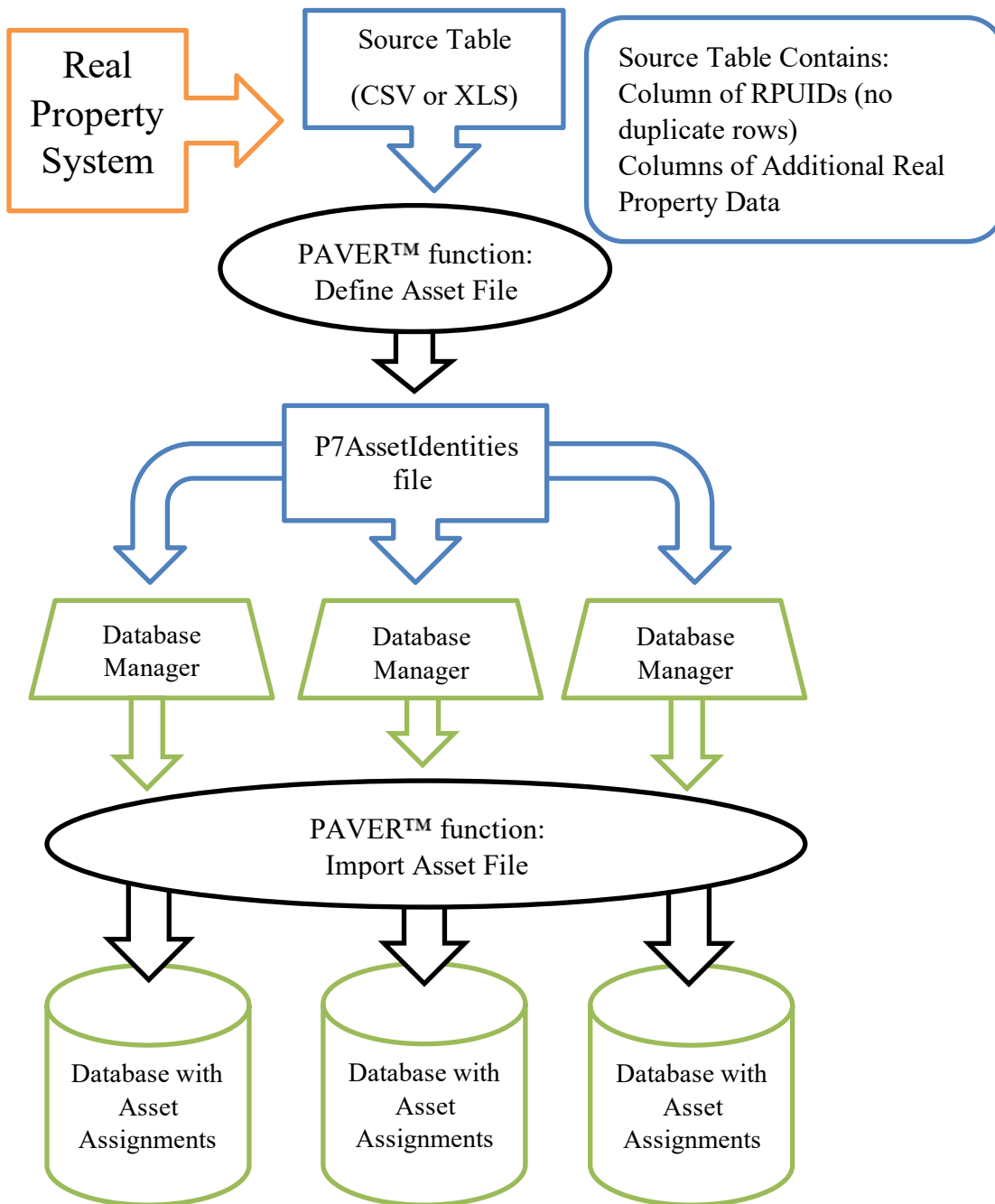
RPUID	Facility ID	Facility Name	Dominant Facility CAT Code	RPSUID	Site Name
21159	NFA100000087443	TAXIWAY J (ON RW 14) TO CALA	11210	1	MCAS CHERRY POINT MAIN BASE
22161	NFA100000086408	VTOL LANDING PAD (KILO TAXIWAY)	11125	1	MCAS CHERRY POINT MAIN BASE
20639	NFA100000085016	COMBAT AC LOAD AREA	11656	1	MCAS CHERRY POINT MAIN BASE
17993	NFA100000063968	AIRFLD PAVEMENTS-TAXIWAY #19	11210	1	MCAS CHERRY POINT MAIN BASE
20030	NFA100000082518	FIVE REFUEL THRU LN BY TAXIWAY H	11210	1	MCAS CHERRY POINT MAIN BASE
20040	NFA100000082616	ACCESS APRON HANGAR 1700	11340	1	MCAS CHERRY POINT MAIN BASE
20939	NFA100000083492	AC WASHRACK PAVEMENT (FAC 1701)	11610	1	MCAS CHERRY POINT MAIN BASE
22022	NFA100000063664	RUNWAY 14L	11110	1	MCAS CHERRY POINT MAIN BASE
18576	NFA100000078499	ACFT WASHRACK BY 1700	11610	1	MCAS CHERRY POINT MAIN BASE
22025	NFA100000063691	RUNWAY 32L	11110	1	MCAS CHERRY POINT MAIN BASE
20031	NFA100000082527	FOUR REFUEL THRU LANE TW A	11210	1	MCAS CHERRY POINT MAIN BASE
20035	NFA100000082563	TAXIWAY BTWN RW 19&23(OLD 10) TXW 11	11210	1	MCAS CHERRY POINT MAIN BASE
20027	NFA100000082484	TAXIWAY E (ECHO)	11210	1	MCAS CHERRY POINT MAIN BASE
18443	NFA100000086382	VTOL LANDING PAD (NE RW32)	11125	1	MCAS CHERRY POINT MAIN BASE
20042	NFA100000082634	WARMUP PAD NO1 BY HUB	11642	1	MCAS CHERRY POINT MAIN BASE
21840	NFA100000062727	TAXIWAY NO. 3 INNER	11210	1	MCAS CHERRY POINT MAIN BASE
20039	NFA100000082607	ACCESS APRON HANGAR 1665-1667	11340	1	MCAS CHERRY POINT MAIN BASE
22024	NFA100000063682	TOWWAY CRASH FIRE	11650	1	MCAS CHERRY POINT MAIN BASE
21842	NFA100000062745	AIRFIELD PAVEMENTS- TAXIWAY D	11210	1	MCAS CHERRY POINT MAIN BASE
18442	NFA100000086391	VTOL LANDING PAD (RUNWAY 23)	11125	1	MCAS CHERRY POINT MAIN BASE
21168	NFA200000332962	TAXIWAY "L" NEAR THE APOE	11210	1	MCAS CHERRY POINT MAIN BASE
20032	NFA100000082526	SPECIAL TAXIWAY BY D-116	11210	1	MCAS CHERRY POINT MAIN BASE

Clear Assignments to Selected Item Clear All Assignments

Close

7.4 Centralized Asset Management

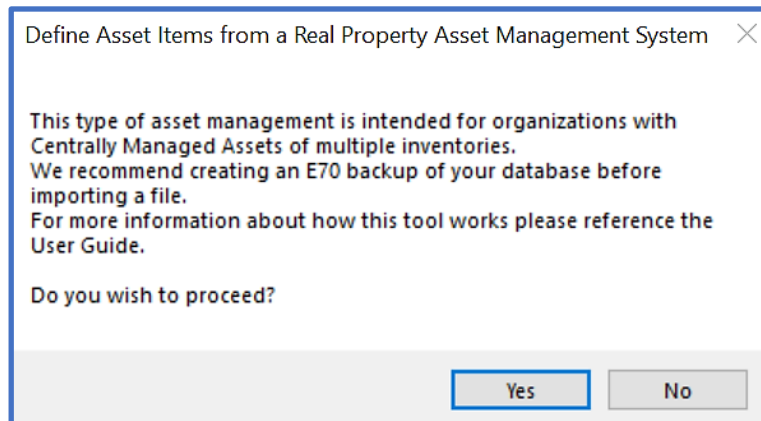
Asset files can be created for distribution or imported using the **Centralized Asset Management** tools. Centralized Asset management is intended for organizations with centrally managed Assets of multiple inventories. See the flow chart below for a visualization of the process.



7.4.1 Create Asset File for Distribution

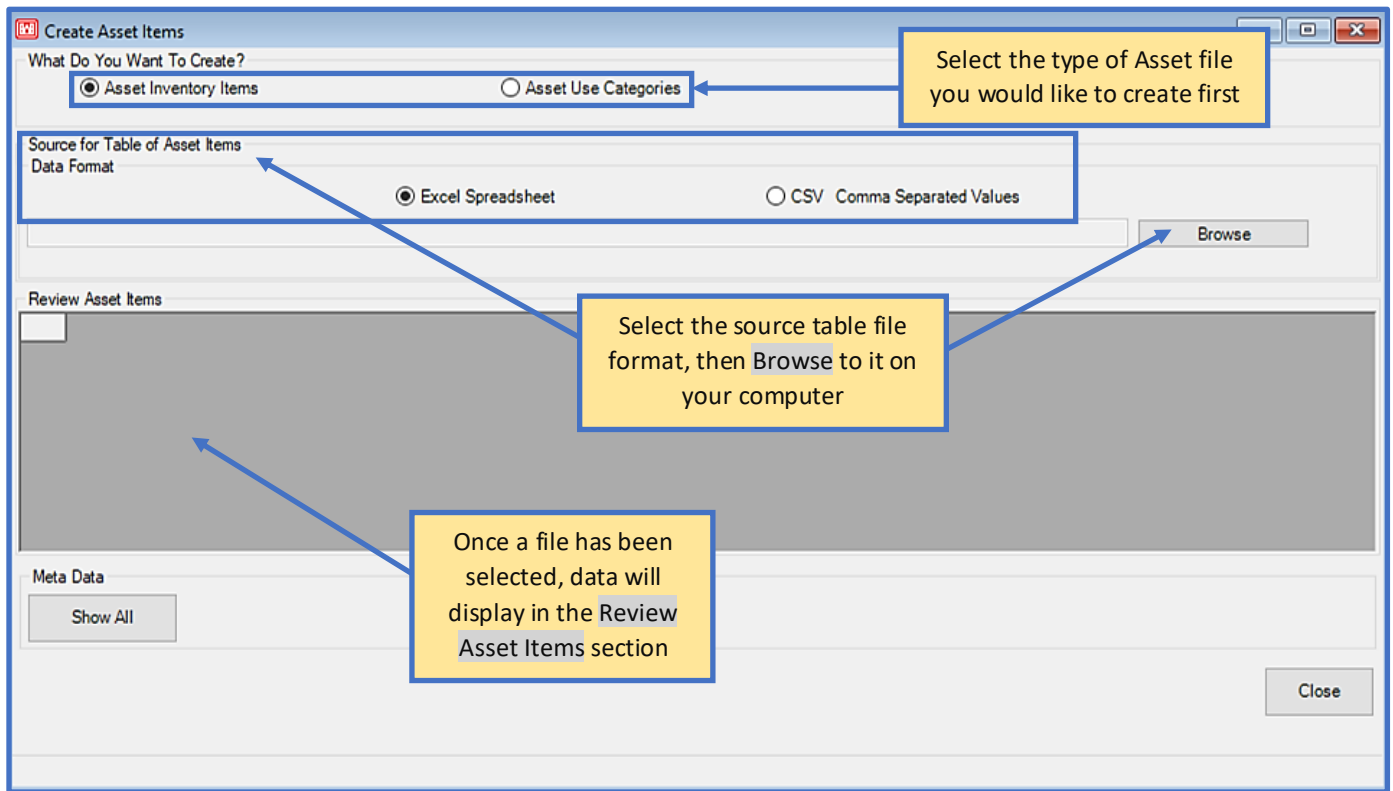
Prior to using the **Centralized Asset Management** tools, the organization's appointed user should create a source table from the Real Property system; a single Excel spreadsheet containing all desired RPUIDs (Real Property Unique ID) to be tracked. Be sure to create an .e70 backup of your database before importing a file (File > **Export Open Pavement Database**). A message displays after selecting **Create Asset File for Distribution**, asking if you would like to proceed.

Note: This function should only be accessed by a single user within an organization to prepare the organization's Asset items.



The **Create Asset Items** form supports CSV and XLS file formats. The file to be imported must contain a column of RPUIDs which does not duplicate row values, this column should be named RPUID. Additional columns from Real Property systems should also be included for import to PCASE 7, as this table will replace the Site and Facility system tables. Recommended columns include: RPUID, Site Name, Facility ID, Facility Name, Dominant CATCD, or any other identifiers. Once the source table has been created and formatted, it is ready to be converted into a P7AssetIdentities file.

Note: Only include desired data in the exported file, as hidden rows and columns will also be imported. Filtering on FACs applicable to PCASE is advised, if your system supports it.

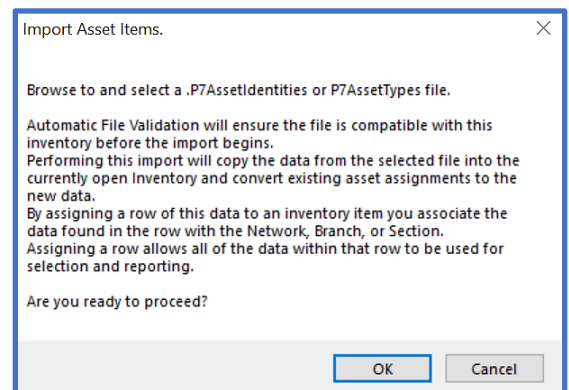


To proceed, select the RPUID column name and optionally the Dominant CATCD column. Select Show All to select from all columns. *Note: If using Show All, edit duplicate values in their desired RPUID column. The program will only save the first row with each value in the selected RPUID column.* After the P7AssetIdentities file has been created, it can now be imported into the appropriate database.

Note: If the desired column name is not available within the RPUID drop-list, the program has found duplicate values in the column.

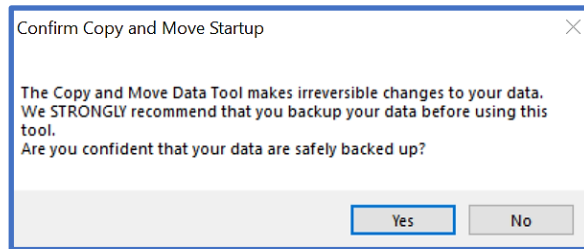
7.4.2 Import Asset File

Ensure the database that you would like to import the P7AssetIdentities file into is currently open. Selecting the Import Asset File tool will prompt an informative message, asking you to confirm prior to proceeding. PCASE 7 will now compare the existing Asset information in the inventory to the file you're attempting to import and will only proceed with the process if all of the current Asset RPUIDs match the IDs in the file.

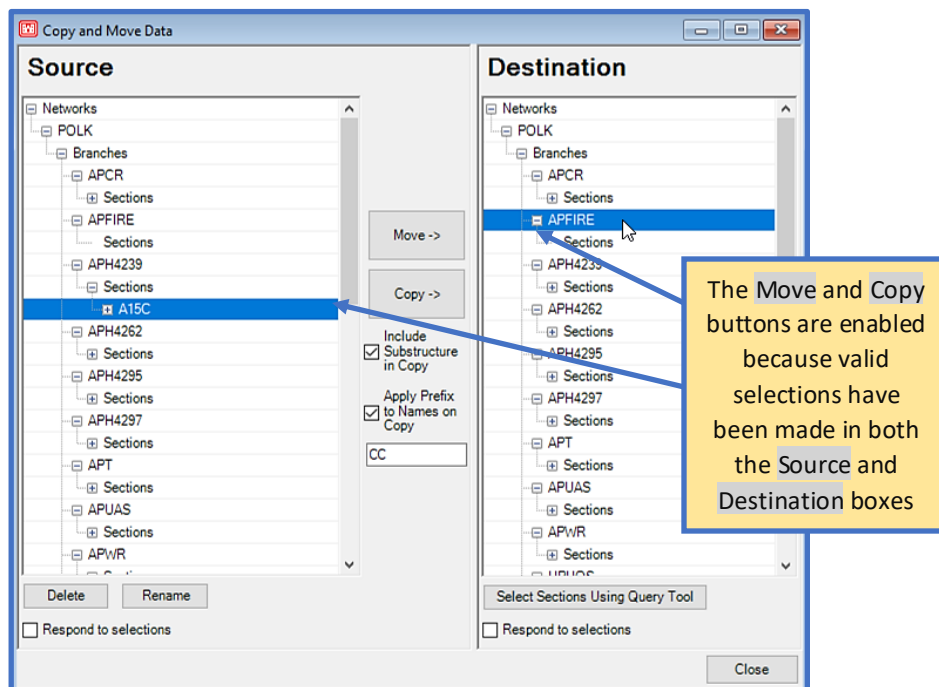


7.5 Copy and Move Data

Prior to using the **Copy and Move Data** tool, first ensure that your data is backed up as this tool makes irreversible changes to data.



Select the inventory item you wish to move or copy from the **Source** box, then select the **Destination** for the inventory item you wish to move or copy. The **Move** button relocates an item to a specified location (**Destination**), while the **Copy** button leaves the original item in its location and places a copy in the specified **Destination**. Both the **Move** and **Copy** buttons remain disabled until an acceptable selection combination has been achieved. All data movement is restricted to the data within the open database. If you wish to move data between databases, use the **Combine Inventories** tool within the **File** menu. The **Copy and Move Data** tool also allows deletion and renaming of inventory data located in the **Source** box. The **Select Sections Using Query Tool** button allows you to select a subset of data. The **Respond to selections** checkbox links the **Copy and Move Data** tool to **Selectors**, so that you can make your selections using the **Selector** tools.

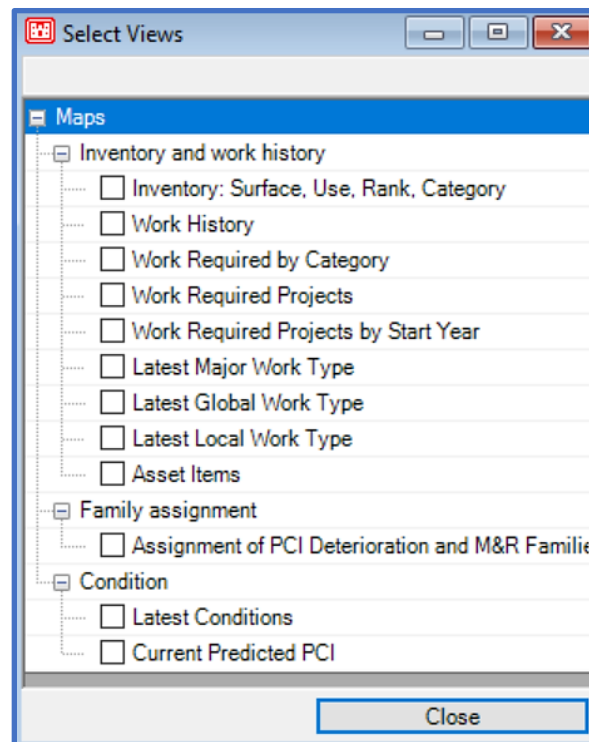


8 Reports

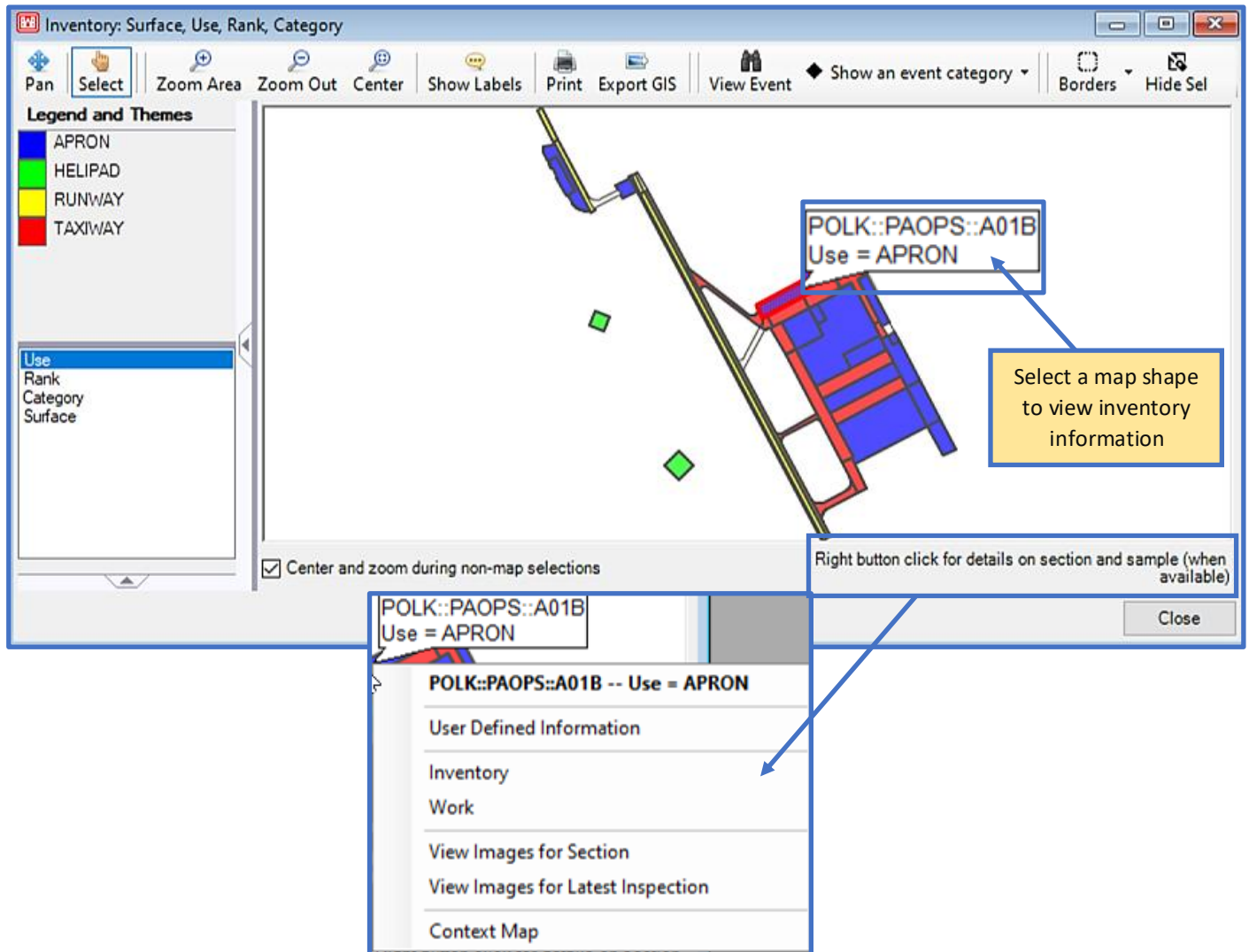
View and filter data in a variety of different ways using the Reports tools. GIS Reports offers multiple GIS map views based on the current inventory and associated data. Summary Charts allow you to select the X Axis and Y Axis from a drop-list of options, as well as Condition criteria for the chart. Enterprise Summary Charts provides options to generate reports grouped by selected attributes and condition type. Standard Reports contains specific report types to choose from, and also allows you to select a subset of the inventory using the Query Tool. Finally, User Defined Reports give you the ability to select from a list of Memorized Reports as well as create a new custom report.

8.1 GIS Reports

The GIS Reports tool provides a tree of GIS map views, which you can select from. Multiple maps can be open simultaneously. Click on an item within the tree to view data.

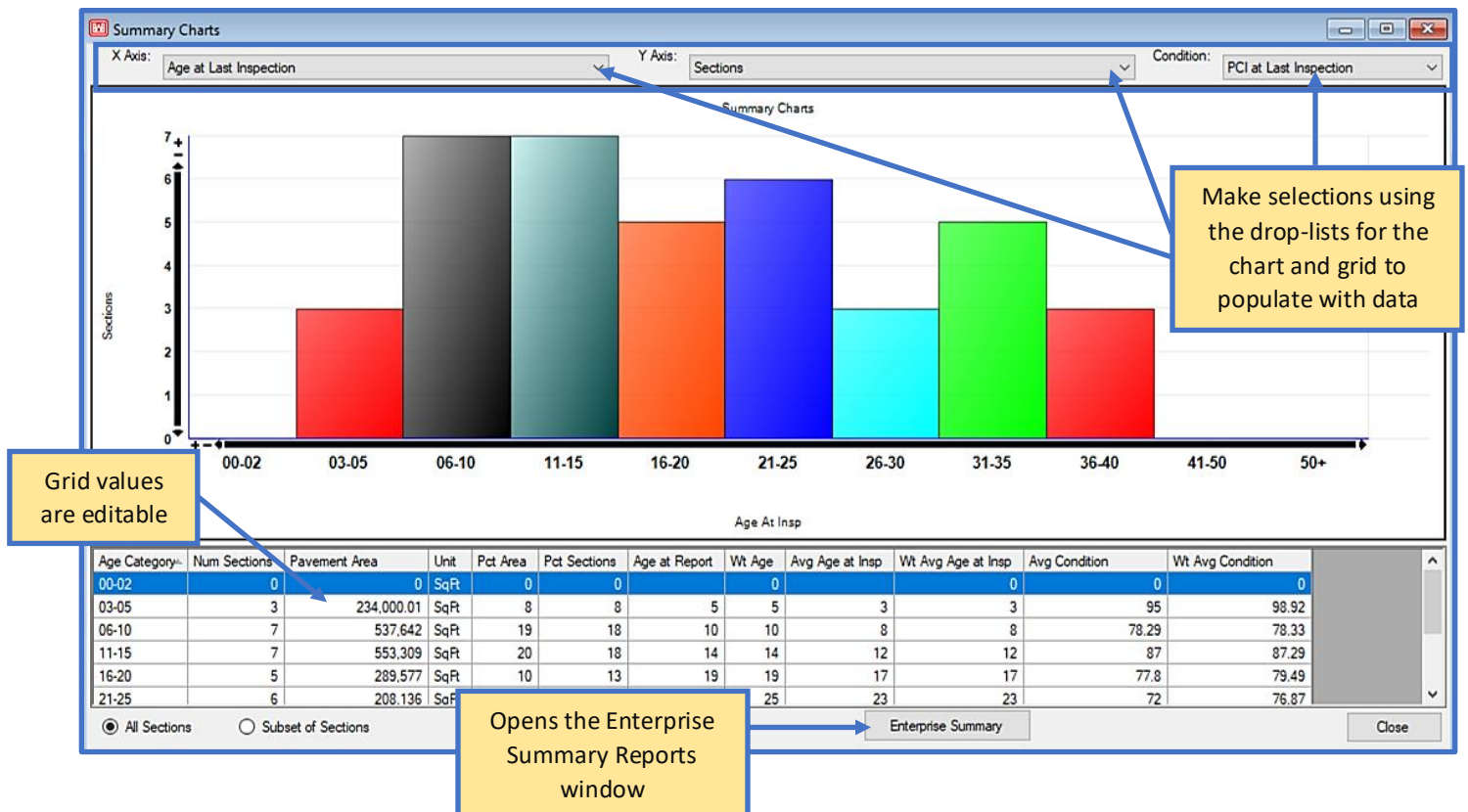


Below is an example of the Inventory: Surface, Use, Rank, Category view. For more information on GIS window functionalities, refer to [Section 7.2 GIS Assignment](#).



8.2 Summary Charts

Graph and compare two attributes of a database using **Summary Charts**. Select categories to represent the X and Y axes using the associated drop-lists, then select a condition index from the **Condition** drop-list. *Note: For the chart to work properly, you must have condition data available for the selected index.* The chart will populate with data after you've made your selections. Below is an example of a **Summary Chart**. Right-click within the chart area for zoom, print, save, and graph property options.



8.3 Enterprise Summary Reports

Enterprise Summary Reports are a reporting feature that allows you to select a **Subset of Sections** or **All Sections** from the currently open database to group by a selection of properties, as well as a selection of condition types for weighted average condition parameters. After you've made selections from both columns, click on the **Calculate** button to generate results in the Condition Groupings window.

Summary For Enterprise

Generate reports that group by the selected attributes on the left and summarize the area weighted average conditions selected on the right.

Group by

Selected	Name
☐	Age at Last Inspection
☒	Age at Time of Report
☒	Branch Use
☒	CAT Code
☐	CAT Code Title
☐	Category
☐	Condition

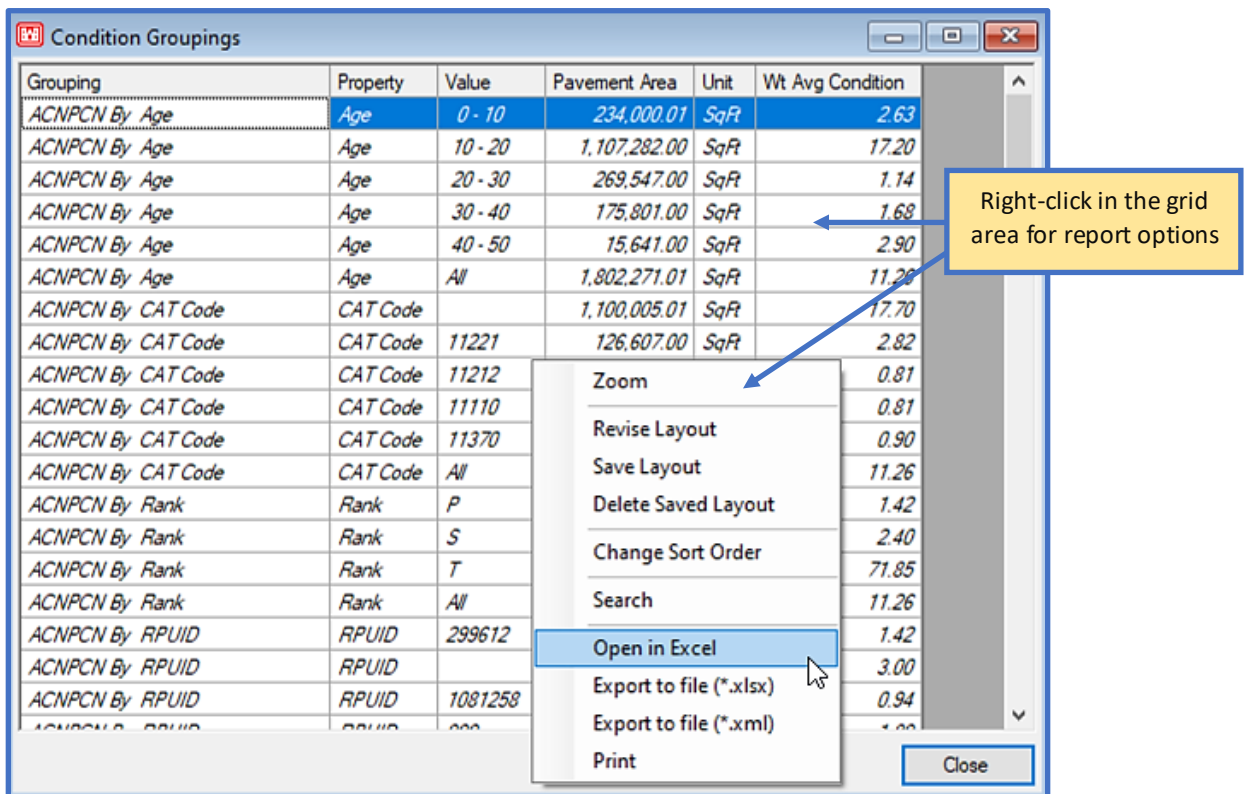
Condition types to include

Selected	Name
☒	ACN/PCN
☐	FOD Index
☐	FOD Potential C-17
☐	FOD Potential F-16
☐	FOD Potential KC-135
☒	FOD Potential Rating
☐	PCI at Last Inspection

☒ All Sections ☐ Subset of Sections

Calculate

Cancel



8.4 Standard Reports

The Standard Reports tool provides five set report options.

- **Branch Listing Report:** Produces a list of all Branches within the database and associated information (eg., usage, number of Sections, total area, etc.), followed by a summary of Network, Branch, Section, Total True Area, and Average Branch True Area totals.
- **Work History Report:** A Section-by-Section report of all work completed within an inventory; over the life of the database. There is a summary at the end of the report which displays Section Count, Area Total, Thickness Avg., and Thickness STD totals for each type of work in a pavement history.
- **Branch Condition Report:** Displays both the average and weighted average condition for each Branch, including standard deviations. After this report has been selected, a list of condition Methods will populate. Choose an item and it will move into the Selected box, the Execute button will also enable so you can run the report. A summary of the Branch condition data is provided at the end of the report.
- **Section Condition Report:** Same report format as the Branch Condition Report, except data is displayed at the Section level. Report data is summarized on the last page.

- **Linear Segmentation Report:** Produces a report containing Real Property Asset information in the database such as RPUIDs, weighted average condition, area, and CATCDs. *Note: Show Asset Items (File > Database Properties > Preferences) must be turned on in order for this report to appear as an option in the list of Standard Reports.*

You can include **All Items** in each report, or use the Query Tool to build a Section subset with the **Build Selection Using Query Tool** option. Click on the **Execute** button to formulate a report. The **Report Viewer** contains a tool bar with report options.

Report Viewer tool bar options for saving, printing, exporting, and editing the background color of the report

Network ID	Branch ID	Name	Use	Number of Sections	True Area (SqF)	Comments
POLK	APCR	COMPASS SWING BASE	APRON	1	14,400.00	Copass rose was reconstructed 0.5 miles south of expansion of TW E
POLK	APFIRE	Fire Station	APRON	1	5,571.00	
POLK	APH4239	HANGAR 4239 APRON	APRON	1	65,043.00	
POLK	APH4262	HANGAR 4262 APRON	APRON	1	15,641.00	
POLK	APH4295	HANGAR 4295 APRON	APRON	1	37,598.00	
POLK	APH4297	HANGAR 4297 APRON	APRON	2	83,643.00	
POLK	APT	RUNWAY TURNABOUT	APRON	1	22,500.00	
POLK	APUAS	UAS Aprons	APRON	2	94,880.00	
POLK	APWR	WASHRACK	APRON	1	50,759.00	
POLK	HPHOS	Hospital Helipad	HELIPAD	1	6,400.00	
POLK	HPWARRIOR	Warrior Helipad	HELIPAD	1	2,500.00	
POLK	PAC130	C130 RAMP	APRON	1	102,025.00	
POLK	PAOPS	OPERATIONS RAMP	APRON	1	104,895.00	
POLK	PAS	SOUTH RAMP	APRON	5	949,441.01	
POLK	RW1634	RUNWAY 16-34	RUNWAY	4	410,000.00	

8.5 User Defined Reports

View **Memorized Reports**, create a new report, or edit an existing report using the **User Defined Report** tools. The **Memorized Reports** drop-list contains previously created/saved User Defined reports in the database. Select a report and the associated data will populate in a grid below, additional GIS map/export options will also appear below the grid. To begin creating a new report, click on the **Create New Report** button to launch the Query Tool. Select the **New** button to name the new report, then proceed with choosing elements for the report. Click on **Memorize** to save the report, then select **Ok** to exit the Query Tool and return to **User Defined Reports**.

QueryTool UserDefinedReport

Memorized Reports

Inventory Items Above Critical

New Copy Memorize Rename Delete

Record Count Refresh Cancel

Refresh Predicted PCI

☒ Filter Value Lists

Select Columns **Select Rows**

Category
Category Description
Comments
Const Date
FOD Aircraft
From Grade
Joint Length
Lanes
Last Global Work Date
Last Global/Major Work
Last Inspection Comme
Last Inspection Date
Last Inspection Total S
Last Local Work Date
Last Local/Major Work
Last Major Work Date
Length
Length x Width
PCI Family
PID
Section Area Adjustme

SectionID

Move Up
Move Down

Use the arrows to move selected items over. Each chosen item from the Select Columns section will be displayed in the right column.

Associated elements from tree selection

This tree reflects the database structure. Select a component of the hierarchy that contains the data elements you wish to include in the report

Right-click in the grid area for print/export options

User Defined Reports

Memorized Reports Inventory Items Above Critical

Drag a column here to group by that column. Enter text to search...

NetworkID	BranchID	SectionID	PCI
POLK	APCR	A04C	96.00
POLK	APFIRE	A22B	75.00
POLK	APH4239	A15C	83.00
POLK	APH4297	A10C	
POLK	APH4297	A18C	
POLK	APT	A13B	
POLK	APUAS	A14B	
POLK	APUAS	A19B	
POLK	APWR	A16C	
HPHOS		A20B	
HPWARRIOR		A21B	
PAC130		A02B	
PAOPS		A01B	
PAS		A03B	
PAS		A07B	
PAS		A08B	
PAS		A09B	
PAS		A17B	89.00
RW1634	R01A1		86.00
POLK	RW1634	R01A2	91.00
POLK	RW1634	R02A1	82.00
POLK	RW1634	R02A2	84.00

Export GIS Map and Data

Export Format

☒ Excel Spreadsheet

☐ CSV Comma Separated Values

☐ ASC Tab Separated Values

☐ XML File

☐ Shape File

Output folder Browse for folder

☐ Include Shapefile

Cancel Ok

Map It GIS Export Close

Review themes for User Defined report

Select which themes you want to show on the map.

Selected	Field Name	Distinct Values	Type
☒	NetworkID	1	String
☒	BranchID	19	String
☒	SectionID	35	String
☒	PCI	23	Numeric

Select all Deselect all

Cancel Ok

If you wish to edit an existing report; select the report from the **Memorized Reports** drop-list, then click on the **Edit Existing Report** button to launch the Query Tool. Once edits have been made, click on **Ok** and you will be prompted to save your changes. Report changes will be reflected the next time the report is ran.

9 Selectors

The **Selectors** menu is comprised of options to help you narrow the scope of an inventory by allowing you to choose specific portions to work with, in a number of different ways. Areas of the program that require you to specify a component of the inventory will respond to the input received from the selector tools. Turn on **Respond to selections** on the APE or LEEP forms to use any of the **Selectors** to change section focus. You can set a program-wide **Default selector** in **User Preferences > Defaults > Overview > Default selector**.

9.1 GIS Selector

If a GIS linkage has been established in PCASE 7 or PAVER™ using the **GIS Assignment** tool, the **GIS Selector** can be used to navigate to Sections of the inventory by clicking on map shapes. When any of the PCASE 7 evaluation modules are have **Respond to selections** turned on, the forms will respond to the Section selections made using the **GIS Selector**.

The screenshot displays the PCASE 7 software interface. On the left, the 'Layer Model' pane lists various sections, with 'POLK::APT::A13B (1 items)' highlighted. A blue arrow points from this section to a red box on a map in the 'Inventory' window. Another blue arrow points from the 'POLK::APT::A13B' section in the 'Layer Model' to a yellow callout box. A third blue arrow points from the 'Respond to selections' checkbox in the 'Settings' pane to a yellow callout box. The 'Settings' pane shows 'Respond to selections' checked. The 'Inventory' window shows a map with a red box labeled 'POLK::APT::A13B'. The 'Results' pane is empty.

Layer Model

Name
POLK::APH4239::A15C (1 items)
POLK::APH4262::A05C (1 items)
POLK::APH4295::A06C (1 items)
POLK::APH4297::A10C (1 items)
POLK::APH4297::A18C (1 items)
POLK::APT::A13B (1 items)
POLK::APUAS::A14B (1 items)
POLK::APUAS::A19B (1 items)
POLK::APWR::A16C (1 items)
POLK::HPHOS::A20B (1 items)
POLK::HPWARRIOR::A21B (1 items)
POI K::PAC130::A02R (1 items)

Settings

☒ Use Backcalculation
☒ Calculate Overlays

Backcalculation Analysis Overlay

FWD data
5 of 20 basins will be evaluated.
Station 1, drop 3 is representative.

Select basin

Inventory

Legend and Themes

Results

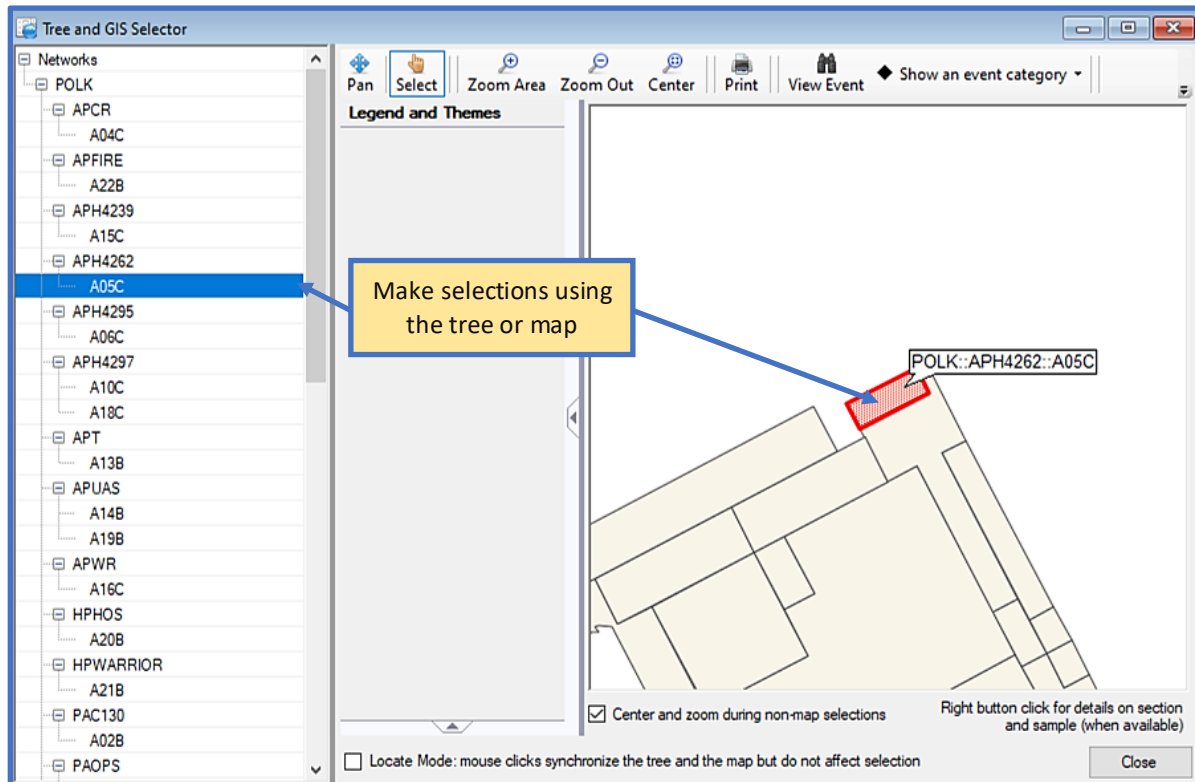
Respond to selections

The evaluation form must have Respond to selections on, to be used in conjunction with Selectors.

Select a Section using the GIS map and the corresponding form will automatically populate that Section's data

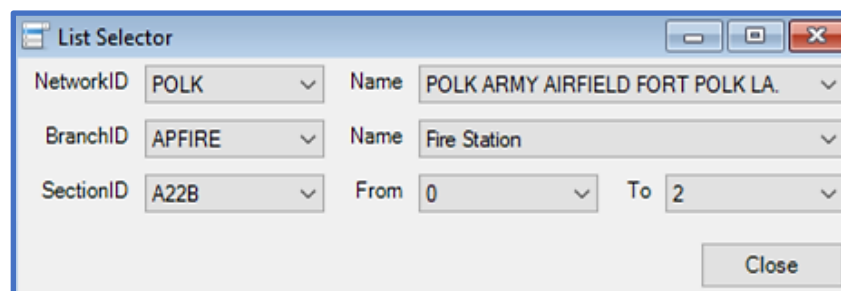
9.2 GIS/Tree Selector

The **GIS/Tree Selector** is simply a combination of the **Tree Selector** and **GIS Selector** displayed in one window. This allows you to select an inventory item using the simplest method for that particular item. For example, if you know only the location of the pavement then the **GIS Selector** would be most useful. If you need to trace through the hierarchy of the inventory; using the **Tree Selector** would be the more logical choice.



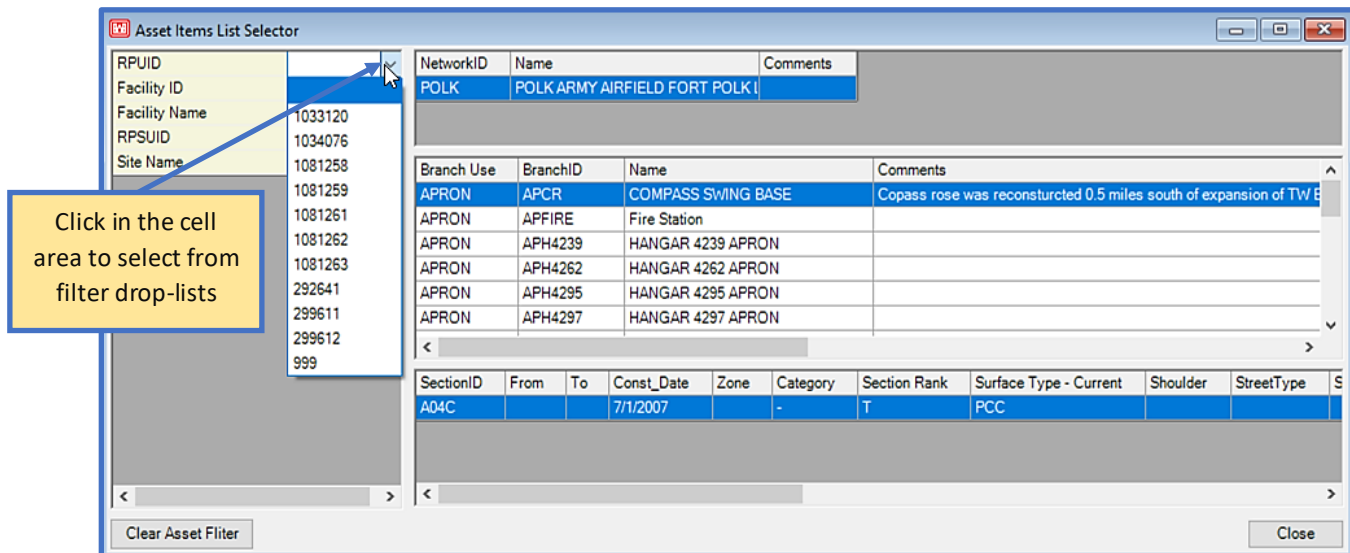
9.3 List Selector

The **List Selector** consists of a series of drop-lists that help you navigate to a specific point in the inventory. While in **Selector Mode**, the **APE evaluation** and **LEEP evaluation** forms will respond to selections made using the **List Selector**. The **FWD data** and **DCP data** forms will also work with the **List Selector** (while in **Selector Mode**) as long as there is data assigned to Sections.



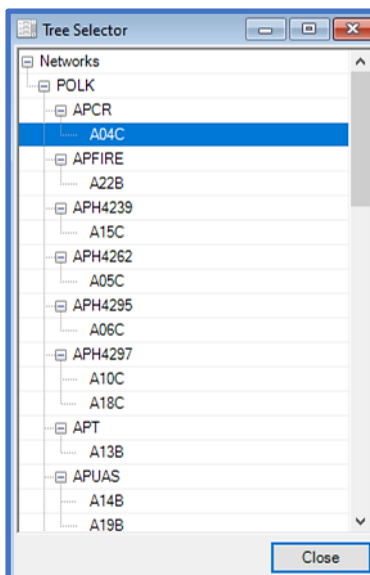
9.4 Asset List Selector

The Asset List Selector tool will only be visible in the Selectors menu if Show Asset Items is turned on in Database Properties. The Asset List Selector works in the same manner as the other Selectors, only it gives you the ability to select Sections based on Real Property Asset filters. Select a row to navigate to that location. A filter can be applied (left-side of grid rows) using the drop-lists next to the items listed in the yellow space, Clear Asset Filter will reset any filters you've applied.



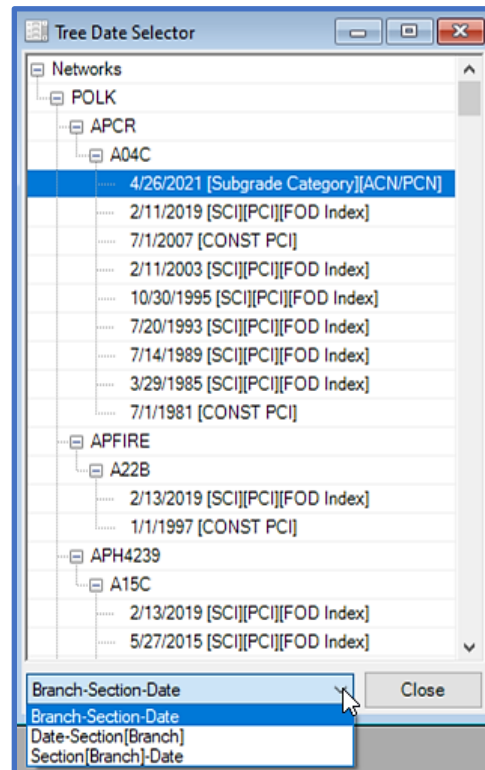
9.5 Tree Selector

The tree structure used in the Tree Selector simulates a Windows file structure and is used throughout PCASE 7. Move through the hierarchy of the inventory structure by moving down the tree, until you've arrived at the desired location.



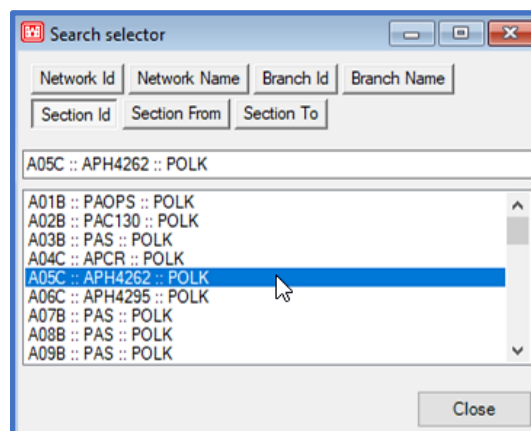
9.6 Tree Date Selector

The **Tree Date Selector** lists work items and inspections by date. Selecting a construction date within the tree will select the corresponding Section. The drop-list at the bottom of the window provides options to change the hierarchy of the tree.



9.7 Search Selector

Search through a database inventory based on seven predefined categories. Click on one of the tab buttons across the top of the form to view related items, and make your selections from the box below. The currently selected item will display within the field above the list box.



10 Work

The **Work** menu consists of tools that give you the ability to manage pavement maintenance, repair, and construction activity.

10.1 Work History

In order to accurately predict future pavement performance, maintenance requirements, cost, and inspection schedule; the system must have an accurate account of the last construction date for each Section. PCASE 7 updates the last construction date for the pavement Section, to correspond with the most recent M&R. The **Work** tab provides an interface for easily entering and managing work history data for Sections. The **Graphs** tab contains a graphic component which presents charts for each Section; relating condition to work history.

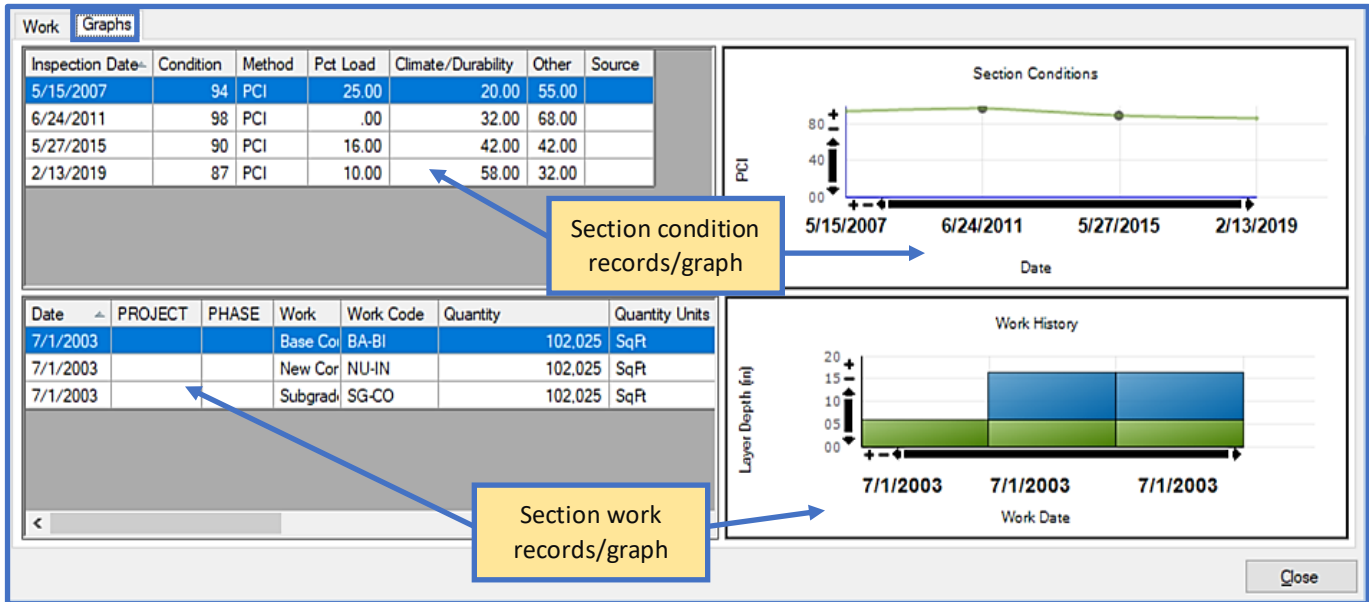
The screenshot displays the 'Work' tab interface. At the top, there is a table with columns: Date, PROJECT, PHASE, Work, Work Code, Quantity, Quantity Units, Cost, Material, Material Code, Thickness, Thickness Units, and Cor. The table contains three rows of data for the date 7/1/2003, representing different work phases: Base Course, New Course, and Subgrade.

Below the table, there are three buttons: 'Add', 'Edit', and 'Copy'. The 'Add' button is highlighted with a yellow box and an arrow pointing to it from a text box that says 'The Add button launches the Add Work Item form so that you can create a new record. The Ok and Apply buttons will enable once you've selected a Work Type from the drop-list'.

The 'Add Work Item' form is open, showing fields for Project, Phase, Section Area, Work Category, Work Date, Thickness, Work Type, Material Type, and a 'Select Item to Be Calculated' section with radio buttons for Unit Cost, Quantity, and Total Cost. The 'Total Cost' option is selected. There is also a 'Comments' field and a 'PAVER Mandatory field' section with a 'Select a Work Type' dropdown. The 'OK' and 'Apply' buttons are highlighted with a yellow box and an arrow pointing to them from the same text box.

Another yellow box with an arrow points to the 'Edit' button, with the text: 'The Edit Work Item form is laid out the same as the Add Work Item form'.

A third yellow box with an arrow points to the 'Work history list' table, with the text: 'Work history list'.



10.2 Add Work History from GIS/Tabular Data

Import work history from a GIS shapefile or tabular report using the **Add Work History from GIS/Tabular Data** tool. The process for using this tool is very similar to the **Add Inventory from GIS/Tabular data** tool ([Section 2.8](#)).

Import Work History Data

Work Data File to Import

☒ GIS Shapefile ☐ Excel Spreadsheet ☐ CSV Comma Separated Values

Browse

Source units

☒ English (Units are in IN/LF/SF) ☐ Metric (Units are in MM/M/SM)

Destination Inventory Database

Mansfield 2015

Shows template file

Buttons will enable once a file has been selected

Cancel < Back Next > Finish

Import Work History Data

Section PID

Network ID: • NETWORKID ▾ Branch ID: • BRANCHID ▾ Section ID: • SECTIONID ▾

Work History Fields

Date: • ▾ Project: ▾ Phase: ▾

Work Code: • ▾ ... Quantity: ▾ Cost: ▾

Material Type: ▾ ... Work Category: • ▾ Thickness: ▾

Comments: ▾

• PAVER Mandatory Field

All the mandatory fields are required

Show template file Cancel < Back **Next >** Finish

Select the appropriate Section PID and Work History Fields using the drop-lists

Select Next to continue the import process

Note: Only specific values are allowed in the Work Category column within the tabular data file. The allowable values are as follows:

"Localized MR"

"LOCALIZED", "LOCAL", "LOCALIZED MR", "LOCALIZEDMR"

"Global MR"

"GLOBAL", "GLOBAL MR", "GLOBALMR"

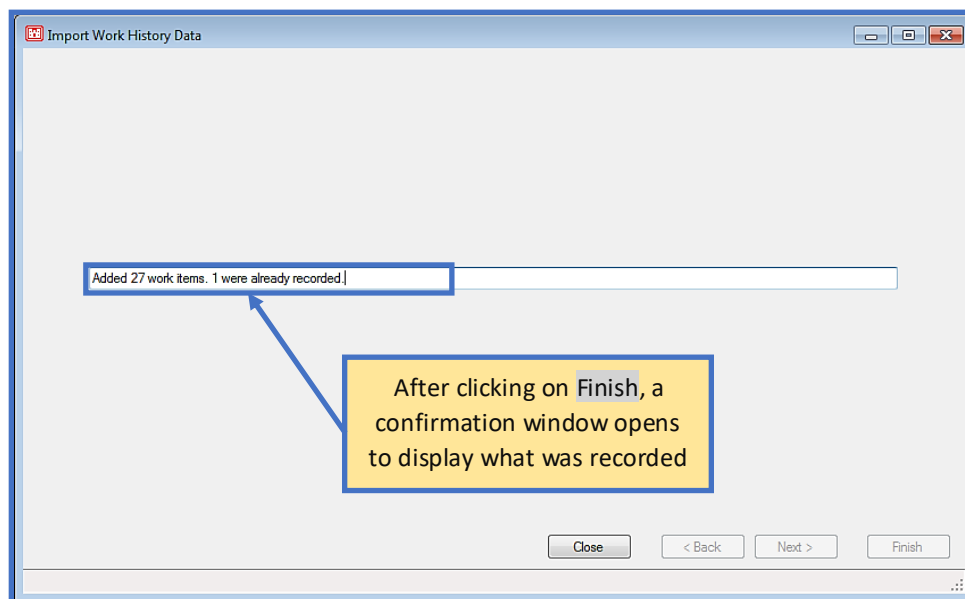
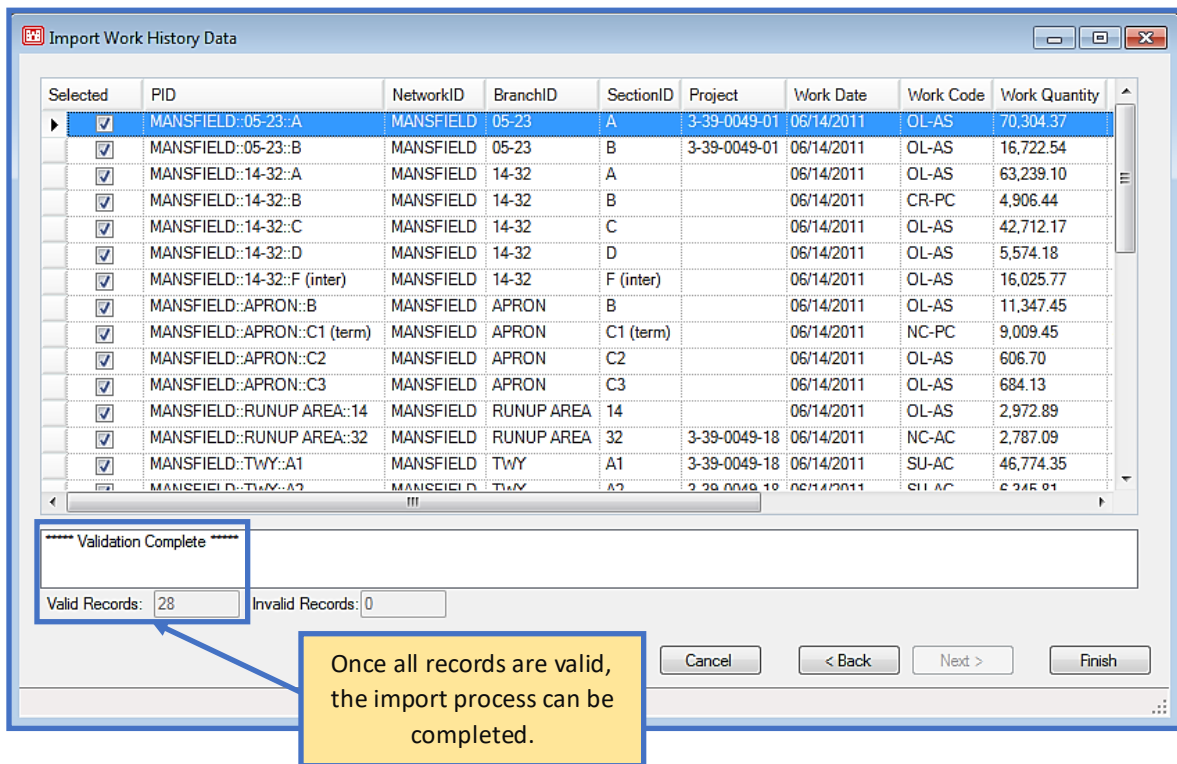
"Major MR"

"MAJOR", "MAJOR MR", "MAJORMR"

"Layer Construct"

"LAYER", "LAYER CONSTRUCT", "LAYER CONSTRUCTION"

The results of the import will be displayed in the next window. Validation results below the grid confirms the number of valid or invalid records, so that you can review and make corrections as needed. Select **Finish** once validation has been completed to finalize the import process.

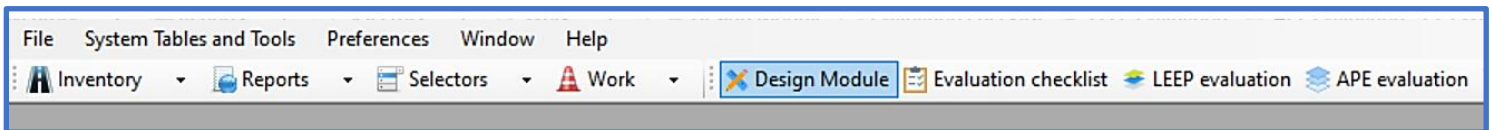


11 Design Module

Prior to beginning a new design project, ensure that you have opened or created a database to store the design project within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference [Chapter 2 File Menu](#).

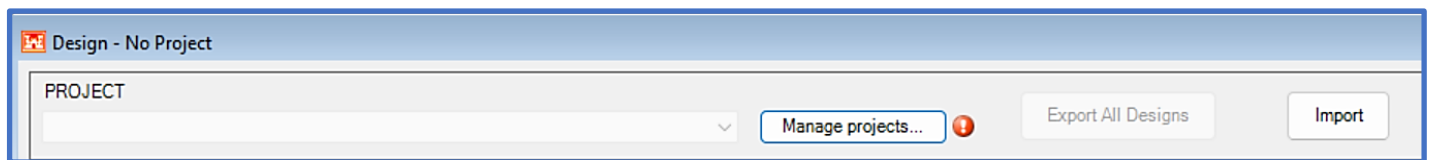
11.1 Getting Started

Select **Design Module** on the PCASE 7 tool bar to get started with Design.

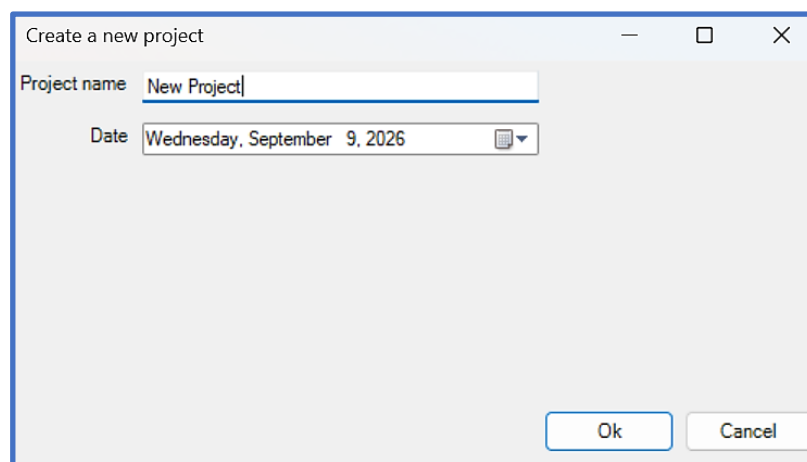


11.2 Project Properties

When the **Design Module** opens for the first time, the only two options are to select **Manage projects...** or **Import** previously exported designs (.p7d files).

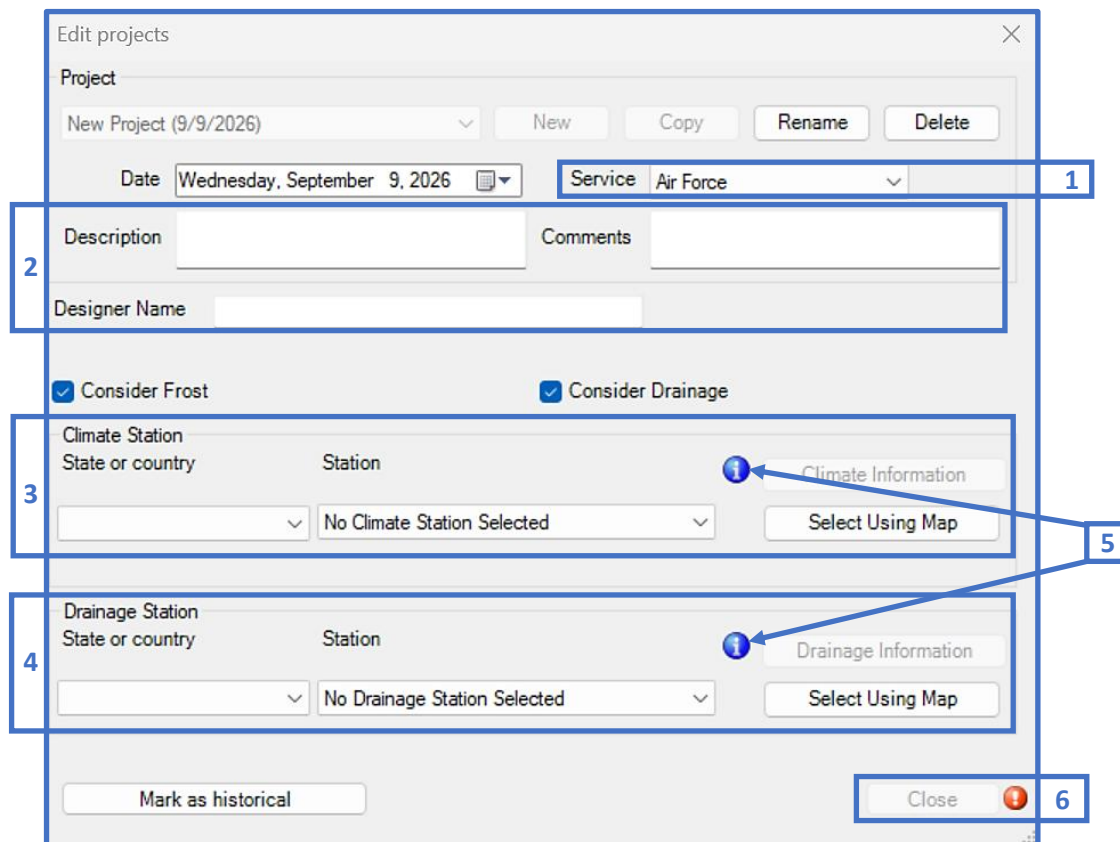


On the “Create a new project” form, name the project, choose a date (or default to the current date), then select **Ok**.



In the “Edit projects” screen:

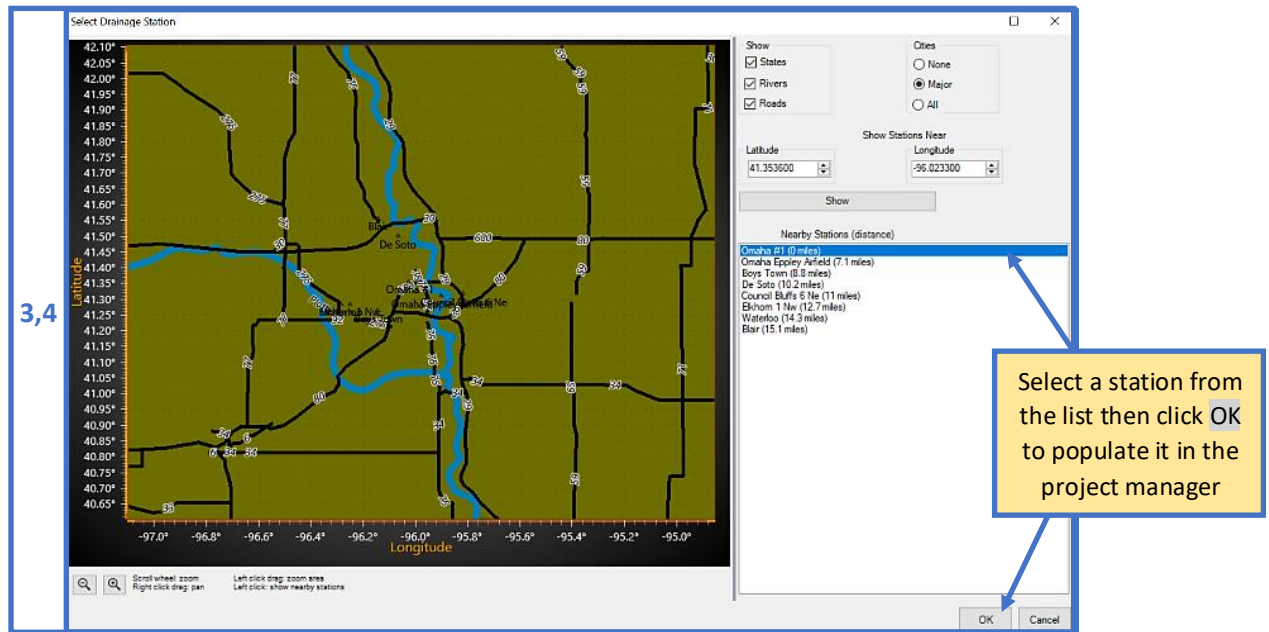
1. Choose the **Service** from the drop-list that is appropriate for the design project.
2. The next three fields are optional. Add a **Description**, **Comments**, and/or **Designer Name**, if so desired.
3. Select the **Consider Frost** checkbox, if applicable. Choose the **State or country** and climate station you would like to pull frost data from for the design. Click on **Select Using Map** to search for and select a weather station. Select an area within the map to populate **Nearby Stations** to choose from, or input your location in the **Latitude** and **Longitude** fields. Once you’ve selected a station, click on **OK** to transpose the station to the project manager.
4. Select the **Consider Drainage** checkbox, if applicable. Choose the drainage station you wish to pull precipitation data from for the design. Click on **Select Using Map** to search for and select a **Drainage station**. Select an area within the map to populate **Nearby Stations** to choose from, or input your location in the **Latitude** and **Longitude** fields. Once you’ve selected a station, click on **OK** to transpose the station to project manager.
5. View the drainage and/or frost data by clicking on the **Drainage Information** or **Frost Information** buttons, or by hovering over the blue info icons .
6. Select **Close** to return to the Design form. *Note: If required information is missing the **Close** button will be greyed out and an error marker icon will display. Hover over the error marker icon  to view the tooltip for next steps.*



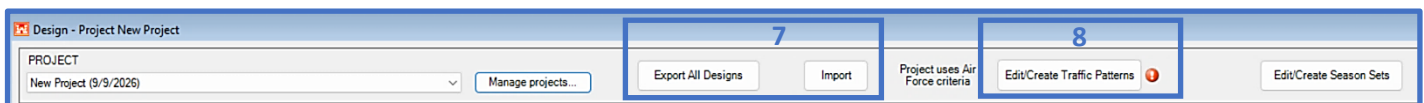
The screenshot shows the 'Edit projects' window with the following elements and callouts:

- Callout 1:** Points to the 'Service' dropdown menu, which is currently set to 'Air Force'.
- Callout 2:** Points to the 'Description', 'Comments', and 'Designer Name' text input fields.
- Callout 3:** Points to the 'Consider Frost' checkbox, which is checked.
- Callout 4:** Points to the 'Consider Drainage' checkbox, which is checked.
- Callout 5:** Points to the 'Climate Station' section, including the 'State or country' dropdown, the 'Station' dropdown (currently 'No Climate Station Selected'), and the 'Select Using Map' button. A blue info icon is also highlighted.
- Callout 6:** Points to the 'Close' button at the bottom right, which is currently greyed out. A red error icon is visible next to it.

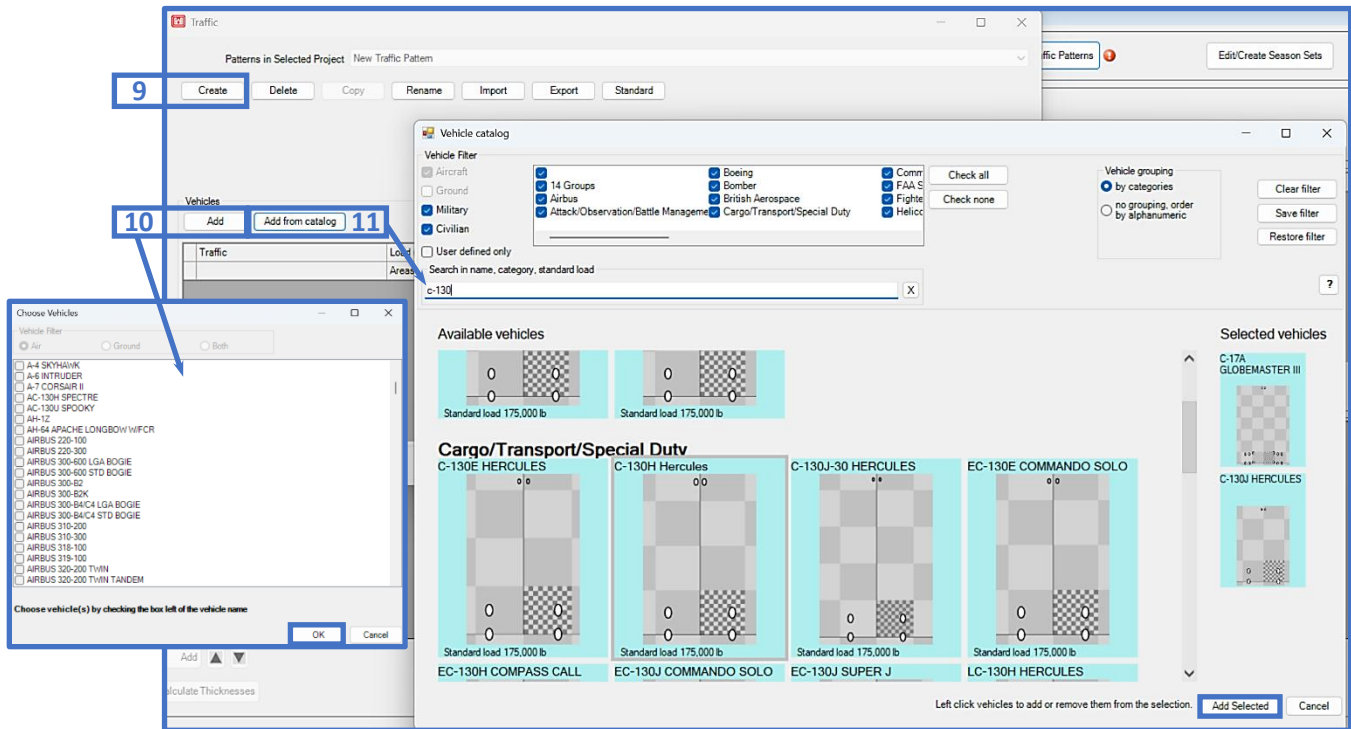
Other visible elements include the 'Project' section with a date picker set to 'Wednesday, September 9, 2026', and buttons for 'New', 'Copy', 'Rename', and 'Delete'.



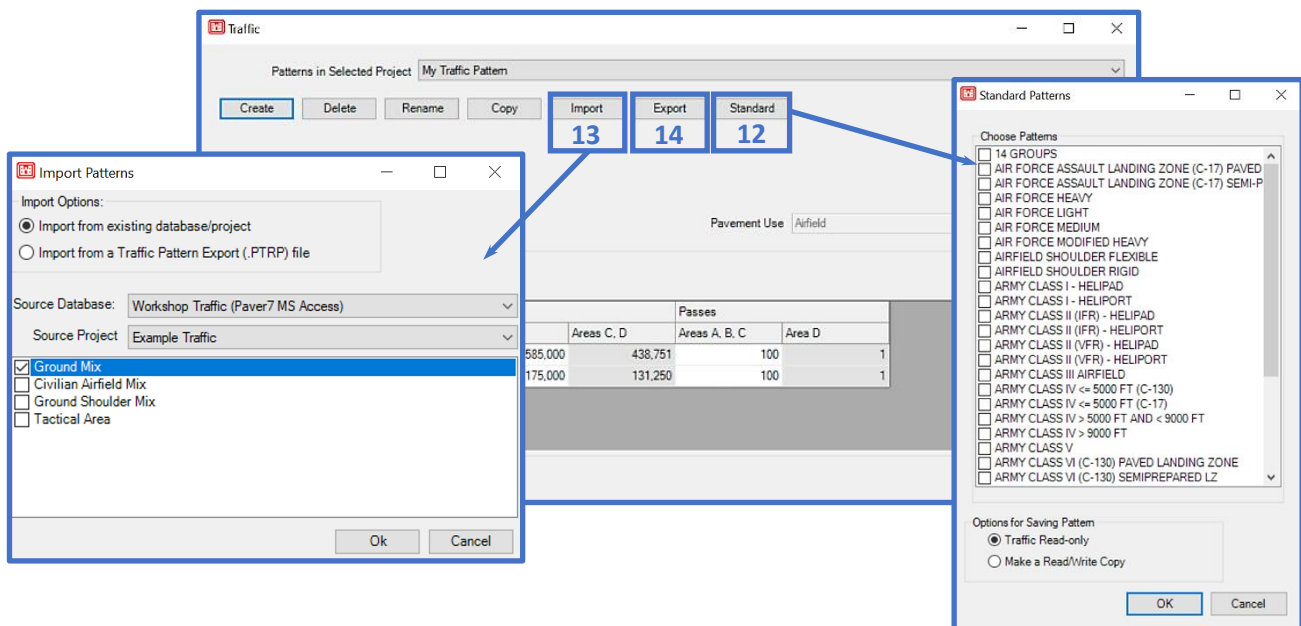
7. Once you've created a design project, the **Export All Designs** feature allows you to create a .p7d file that can be shared and imported using the **Import** button. Selecting the **Export All Designs** button launches file explorer so you can give the exported file a name and choose where to save it. The **Export Design** button works similarly; it allows you to export an individual design as opposed to all of the designs in a project. To import a .p7d file, select the **Import** button. File explorer launches so you can navigate to the file location, select the file then click Open. A list is displayed to show which design properties were successfully imported. Click **OK** to close the window and the imported design(s) populate within the design form. *Note: When an individual design is imported, a new project is created for the design so that the project level properties are not lost.*
8. Click on the **Edit/Create Traffic Patterns** button to define traffic for the project.



9. To define a new traffic pattern with specific vehicles, select **Create**. Enter a **Pattern Name**, select a **Pavement Use**, and then click **Ok**.
10. Click **Add** to select vehicles from the **Choose Vehicles** form. An **Air**, **Ground**, or **Both** vehicle filter is available. Click the box left of the vehicle name or on the vehicle name to select it. Click **OK** to assign the selected vehicles to the pattern.
11. Select **Add from Catalog** to open the vehicle catalog. Filter vehicles based on set categories or by typing a vehicle name in the search field. A visual representation of each vehicle's gear configuration is displayed. Selected vehicles are shown on the right-side of the form. Once all vehicles have been selected for the traffic pattern, click **Add Selected**.



12. Choose **Standard** to select from Tri-Service, pre-defined traffic patterns. Click the box left of the standard pattern name or on the name to select it. At the bottom of the form is the option to save the pattern as “Traffic Read-only” (default) or “Make a Read/Write Copy”. Click **OK** to assign the selected pattern.
13. Choose **Import** to select an existing traffic pattern from a database/project or import a previously exported traffic pattern (.ptrp file).
14. Select **Export** to save a file with the selected traffic pattern. File explorer opens to allow you to save a .ptrp file, which can be shared and imported back into PCASE.



15. The **Pavement Use**, related to the pattern is displayed.
16. Values for **Load** and **Passes** can be edited within the grid cells. For custom traffic patterns, input the number of **Passes** for the entire life of the pavement (based on pavement use) for each vehicle. The airfield pavement design life is for 20 years and the roads and parking design life is for 25 years. For example, enter 40,000 passes for a 20-year design life at 2,000 passes per year.
17. The **Auto Detect Controlling for CBR/K** option is turned on by default and automatically calculates the controlling traffic for mixed traffic patterns. Uncheck the checkbox to select a different controlling vehicle from the **Select Controlling Vehicle** drop-list.
18. Select **ACN/ACR Curves** to view the vehicle Aircraft Classification Number (ACN) and Aircraft Classification Rating (ACR).
19. Select **Close** to exit Traffic and return to the Design form.

Traffic

Patterns in Selected Project: C-17A and C-130J

Create Delete Rename Copy Import Export Standard

15 Pavement Use: Airfield

18 ACN/ACR Curves

16

Traffic	Load (lb)		Passes	
	Areas A, B	Areas C, D	Areas A, B, C	Area D
C-17A GLOBEMASTER III	585,000	438,751	5,000	50
C-130J HERCULES	155,000	116,250	10,000	100

17 ☒ Auto Detect Controlling for CBR/K

☐ Auto Detect Controlling for CBR/K Select Controlling Vehicle: C-17A GLOBEMASTER III (585,000.00)

19 Close

Note: Traffic areas A, B, C, and D only apply to airfields. Roads will display one column each for load and passes.

For CBR/K layer structures, you can manually select the controlling vehicle to use in the calculation by unchecking the Auto Detect Controlling for CBR/K option and choosing a vehicle from the drop-list

20. Select **Edit/Create Season Sets** to build a custom season set (*Layered Elastic Design (LED) only*). Modulus values will be assigned for each season in the layer model properties. LED defaults to one season, created season sets can be selected from the **Season Set** column fieldc drop-list.

Design - Project My Project

Project: My Project (9/23/2020) Manage projects...

Project uses Air Force criteria

Edit/Create Traffic Patterns Edit/Create Season Sets **20**

21. Select **Add** within the **Season Sets** form to begin.
22. Enter a season set **Name**, input the **Number of Seasons** to create for the season set, then click **Add**.
23. The grid populates with a row for each season specified on the **Add season set** form. Update the dates within the grid, then select **Apply**.
24. If modifications need to be made to a created season set; edit the date field and select the **Add Season Starting On** button to add an additional season to the selected season set. To delete a single season from a season set, highlight the **Season #** within the grid, then select **Delete Selected Season**. Select **Apply** to save changes.

The Delete season set button is only enabled for season sets that have not yet been used in a design project.

Season Sets

4 seasons
All Year

Add **Rename** **Delete**

Season #	Starting Date	Ending Date	# Of Days	% Of Year
1	Dec 1	Mar 31	121	33.15
2	Apr 1	Jun 30	91	24.93
3	Jul 1	Sep 30	92	25.21
4	Oct 1	Nov 30	61	16.71

23

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

24 **Add Season Starting On** Jan 01 **Delete Selected Season** **Apply**

21

Add

AddSeason Set

Name:

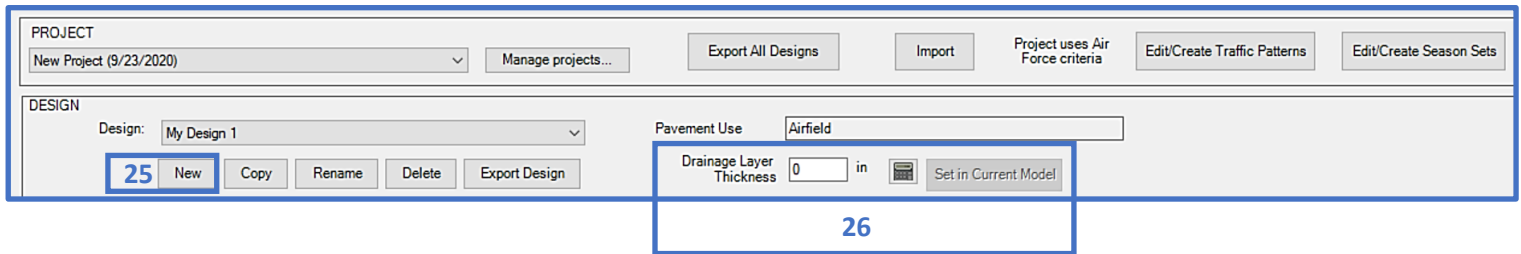
Number Of Seasons: 4

Add **Cancel**

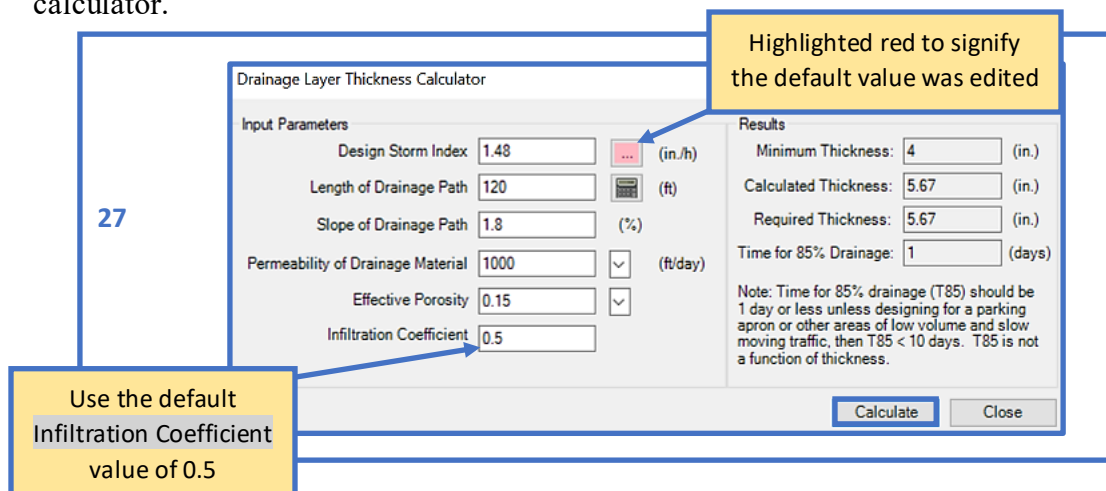
22

11.3 Design Properties

25. Select **New** to add a **Design Name** and choose the **Pavement Use** (**Airfield** or **Roadway/Parking**) for the design.
26. If you opted to **Consider Drainage** in **Manage projects**, the **Drainage Layer Thickness** field and calculator will be enabled. Enter a value in the **Drainage Layer Thickness** field or use the calculator  to determine a calculated value. If a calculated Drainage layer thickness changes in subsequent layer models, click the **Set in Current Model** button to update the layer grid. Proceed to Step 28 if you choose not to consider drainage.



27. To use the **Drainage Layer Thickness Calculator**, click on the icon. The **Design Storm Index** value will be pulled in from the **Weather station** selected in **Manage projects**; the value may be edited. Select the calculator icon to the right of the **Length of Drainage Path** field to open the **Drainage Path Calculator**. Input values for **Length of Transverse Slope**, **Transverse Slope**, and **Longitudinal Slope**, then click on **Calculate** and the window will close and transpose the **Length of Drainage Path** and the **Slope of the Drainage Path** to the **Drainage Layer Thickness Calculator** window. Select a value from the drop-down field for **Permeability of Drainage Material** or input a value, then edit the **Effective Porosity** by using the drop-down options or by inputting a value. Click on the **Calculate** button to display results then **Close** the form. The calculated thickness will transpose to the **Drainage Layer Thickness** field in the **Design Properties** section upon closing the calculator.



11.4 Layer Properties

28. Select **New**, enter the **Layer Model Name** and choose the appropriate; **Pavement Type**, **Analysis Type**, **Traffic Pattern**, and **Traffic Area**. In Layer Manager, if **Consider Drainage** was checked the **Use Drainage Layer** box will be enabled. It may be unchecked if a drainage layer is not required for the model. Select **Ok** to return to the Design form. Select **Copy** to copy a layer model in the current design. Select **Import** to import a model layer from another design within the current database. Select **Delete** to delete a layer in the current design.
29. A layer structure will now populate within the layer grid section. Default values within the layer grid column fields are given. All fields are editable unless colored in gray, this signifies that the cell is set to read-only. *Note: If unacceptable values are entered into the layer grid, the cell will color red and an error marker icon will display, hover over the error marker icon  to view a tooltip which displays the acceptable value range.*
30. Layers and their coinciding material types can be added or edited using the **Add** or **Change** buttons beneath the layer grid. The **Change** layer button becomes enabled when the selected layer can be modified. The **Delete** button becomes enabled when a removable layer is selected. The Up and Down arrows enable when the selected layer can be moved.
31. Select a **Frost Code** for the subgrade layer from the drop-list within the **NFS** column cell.
32. The **Override calculated depth of frost** check box will be unchecked by default for newly-created layer models, which means the calculated depth of frost value will be used for the layer model. Select the check box to input your own value in the field.
33. A default **Compaction Class** is automatically selected for you. Select the ellipsis button next to the **Compaction Class** drop-list to view compaction requirement tables; based on the selected layer model. Additional compaction classes are available for selection using the **Compaction Class** drop-list, the available options in the list are dependent on pavement type, Service (for flexible pavements), and traffic area.
34. The **Report** button launches a form for you to select designs within the selected project to include in the report, each layer model is presented on a different tab within the spreadsheet. The button will enable once layer model results have been computed.

PROJECT
New Project (9/23/2020) Manage projects... Export All Designs Import Project uses Air Force criteria Edit/Create Traffic Patterns Edit/Create Season Sets Report

DESIGN
Design: My Design 1 Pavement Use: Airfield 45 Design is for evaluating alternatives 34
New Copy Rename Delete Export Design Drainage Layer Thickness: 5.67 in Set in Current Model

LAYER MODELS (in My Design 1)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
Runway Interior	Flexible	CBR	AIR FORCE MEDIUM-Copy	Traffic Area C	All Year	140.00	N/A

28 New Copy Import Delete

Compaction Class: Air Force Medium Airfield 33

LAYER MODELS (in Runway Interior)

32 Override calculated depth of frost Depth of Frost: 32 in. 32 Override calculated depth of frost Depth of Frost: 25 in.

Layer Type	Material Type	CBR	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft ³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)
Asphalt Concrete	Asphalt Cem...		NFS		140	☒	5.00	4.00	0.00	0.00
Base	Unbound Ag...	80	NFS	5	135	☒	8.00	6.00	0.00	0.00
Drainage	Unbound Ag...	50	NFS	5	135	☐	5.67	4.00	0.00	0.00
Separation	Unbound Ag...	50	NFS	5	135	☐	4.00	4.00	0.00	0.00
Natural Subgrade	Cohesive Cut	6	F3F4	18	100	☐				

29 30 Add Change Delete

31

Frost Design Selection Subgrade Preparation Compaction

View Traffic Pattern

C-17A GLOBEMASTER III - 585,000 lb, 402,980 Passes

Close

The active layer model is highlighted in blue

Uncheck Compute checkbox before editing a layer thickness value

35. Once you are satisfied with all inputted and/or default values for the layer structure, click on the **Calculate Thicknesses** button. When frost values are used, the controlling design column will highlight in blue. *Note: When all the required fields are filled, the red icon  will display indicating Calculate Thicknesses.*
36. Select **Compaction** to display a graphical representation of the compaction requirements. The left column displays the compaction percentage and depth. For cases in which a compaction percent crosses a layer boundary, an additional column (between the **Compaction** and **Layer** thicknesses columns) will display to show the depth for each layer it spans. If the remaining compaction percentage is not already specified within the graphic, the natural compaction percent of the soil can be inputted within the **Remainder of natural compaction of...** field. Select **Export to Excel** to save a copy of the graphic.
37. Select **Frost Design Selection** to display the criteria and guidance for selecting the correct frost design.
38. Select **Subgrade Preparation** to display the calculated required depth of subgrade preparation.
39. Select **View Traffic Pattern** to display the Traffic assigned to the model; includes the vehicles, weights and passes. The controlling vehicle and equivalent passes are also shown, for CBR analysis type only.
40. Select **Joints/Dowels** to display the joint spacing and dowel requirements based on the concrete thickness. *Note: The **Joints/Dowels** button only appears for rigid designs.*

41. The **Stresses/Strains** button is enabled for LED only; when selected a form is launched that displays a table of stresses and strain data, the layer structure, and vehicle information for the selected layer model. Values can be added or removed in the **Calculation Depths** section.
42. The **AASHTO ESALs** button is only available for road designs. The parameter values used for the calculation can be viewed on the form.
43. The **Damage** button is only available for LED. The form displays cumulative damage based on the traffic or season set for the selected layer model.
44. The **Sensitivity** analysis button becomes enabled after thicknesses have been calculated for non-overlay K and CBR analysis designs. Select a value from the **X Axis Selection** drop-list to execute the analysis, a graph populates to display the data. Mouse over individual points on the graph to view values.
45. **Design** is for evaluating alternatives populates buttons above the layers grid for generating and comparing multiple models.
46. Select **Close** to exit the Design Module.

The screenshot displays the Design Module interface. The main window is titled "LAYERS (in Runway Interior)". It features a table with columns: Layer Type, Material Type, CBR, Frost Code, Moisture Content %, Dry Unit Weight (lb/ft³), Compute, Non-Frost Design Thickness (in), Min. Thickness (in), Reduced Subgrade Strength (in), and Limited Subgrade Frost Penetration (in). The table lists layers: Asphalt Concrete, Base, Drainage, Separation, and Natural Subgrade. Below the table are buttons for "Add", "Change", "Delete", "Calculate Thicknesses" (35), "Sensitivity" (44), "Frost Design Selection" (37), "Subgrade Preparation" (38), "View Traffic Pattern" (39), and "Compaction" (36). A yellow box highlights the "Design" button (33) with the text "The controlling design is highlighted". A "CompactionRequirements" pop-up window shows a table of compaction requirements for different layers. A "Sensitivity Analysis" pop-up window shows a graph of Non-Frost Thickness (in) vs. Natural Subgrade CBR. A "Joints/Dowels" pop-up window shows joint/dowel information based on non-frost PCC thickness, including joint spacing and dowel dimensions. A "Close" button (46) is located at the bottom right.

Layer Type	Material Type	CBR	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)
Asphalt Concrete	Asphalt Cement		NFS	0	140	☒	4.00	4.00	4.00	4.00
Base	Unbound Aggregate	80	NFS	5	135	☒	16.58	6.00	30.90	16.58
Drainage	Unbound Aggregate	50	NFS	5	135	☐	5.67	4.00	5.67	5.67
Separation	Unbound Aggregate	50	NFS	5	135	☐	4.00	4.00	4.00	4.00
Natural Subgrade	Cohesionless Cut	6	F3F4	10	120	☐			0.00	0.00

Design buttons: 35 Calculate Thicknesses, 44 Sensitivity, 37 Frost Design Selection, 38 Subgrade Preparation, 39 View Traffic Pattern, 36 Compaction, 33 Design, 46 Close.

CompactionRequirements pop-up window:

Compaction	Layer
4.0" - Asphalt Concrete	
16.6" - Base	
30.2" - 100%	
5.7" - Drainage	
4.0" - Separation	
16.0" - 95%	
23.0" - 90%	
21.0" - 85%	
	Natural Subgrade

Sensitivity Analysis pop-up window:

X Axis Selection: Natural Subgrade CBR

Graph: Non-Frost Thickness (in) vs. Natural Subgrade CBR. Legend: Asphalt Concrete Thickness (red line), Base Thickness (blue line).

Joints/Dowels pop-up window:

Joint/Dowel Information

Joint/dowel information based on non-frost PCC thickness

Joint Spacing: 20 ft.

Dowels

Spacing: 18 in.

Length: 20 in.

Diameter: 1-1.5 in.

OK

Layered Elastic Detailed Results

LayerType	Thickness (in.)	Modulus (psi)	Poisson's Ratio	Bond
Asphalt Concrete	5.47	200,000	0.45	Fully Bonded
Base	7.78	61,000	0.35	Fully Bonded
Drainage	5.67	45,000	0.30	Fully Bonded
Separation	4.00	45,000	0.30	Fully Bonded
Natural Subgrade	219.00	15,000	0.40	N/A

B-52H STRATOFORTRESS - 400 kips

Applied Loads

Tire Number	X (in.)	Y (in.)	Load (lbs)	Contact Area (in ²)
2	68.00	0.00	52,000	271.46
4	31.00	0.00	52,000	271.46
6	-31.00	0.00	52,000	271.46
8	-68.00	0.00	52,000	271.46

Evaluation Points

X (in.)	Y (in.)
0.00	0.00
31.00	0.00
49.50	0.00

Calculation Depths

Depth (in.)
5.473816587740...
22.92318381058...

Add Remove

Parameter

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
X Coord. (in.)	4.9500E+001	3.1000E+001	0.0000E+000	4.9500E+001	3.1000E+001	0.0000E+000
Y Coord. (in.)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Z Coord. (in.)	5.4738E+000	5.4738E+000	5.4738E+000	2.2923E+001	2.2923E+001	2.2923E+001
Stress X (psi)	1.0251E+002	-1.1116E+002	3.4859E+001	6.9809E+000	4.2635E+000	9.1131E+000
Stress Y (psi)	1.8820E+001	-1.1260E+002	2.0071E+001	-2.8450E+001	-3.2622E+001	5.3616E+001
Stress Z (psi)	1.0794E+001	1.5379E+002	1.3149E+000	2.0186E+001	2.4390E+001	1.0051E+001
Shear Stress XZ (psi)	-1.1528E+001	3.2229E+000	-3.8858E+016	-6.2317E+001	1.5650E+000	1.1102E+016
Shear Stress YZ (psi)	2.2023E+015	8.2373E+017	7.8075E+016	7.5290E+016		
Shear Stress XY (psi)	4.9816E+015	-2.8886E+016	9.0546E+016	5.1049E+016		
Strain X	4.4591E-004	-6.4847E-004	1.2618E-004	-6.5304E+005		
Strain Y	-1.6083E-004	-6.5890E-004	1.8964E+005	-7.4340E+004		
Strain Z	-2.1902E-004	1.2724E+003	-1.1702E+004	1.1671E+003		
Shear Strain XZ	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000		
Shear Strain YZ	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000		
Shear Strain XY	3.6116E+020	-2.0942E+021	6.5646E+021	4.7646E+020	2.0508E+020	4.5016E+020
Displacement X (in.)	-1.1026E+003	-8.7652E+004	0.0000E+000	2.7031E+003	-1.1988E+003	4.3368E+019
Displacement Y (in.)	-0.0465E+020	1.4377E+019	7.7688E+020	-1.1384E+018	-5.2967E+019	-1.0807E+018
Displacement Z (in.)	1.0192E+001	1.2187E+001	8.7706E+002	9.4871E+002	9.8369E+002	8.6126E+002
Princ. Stress 1 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Stress 2 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Stress 3 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Strain 1	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Strain 2	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000

Export Zoom Layout

If the drop-list is enabled

Right-click within the table for export, zoom, and layout options

If the drop-list is enabled you can select another vehicle from the traffic pattern.

AASHTO 1993 Vehicle Equivalent Single Axle Loads (ESAL) Equation Definitions:

$$1 \text{ kip} = 1000 \text{ lb}$$

x = Vehicle axle load under consideration in kips

W_0 = Number of x -axle load applications at the end of time t

W_{18} = Number of 18-kip single axles to time t

L_s = Load (in kips) on a single, tandem, or tridem axle

SN = Structural Number (Flexible pavements only), $SN = 5$ is assumed

L = Axle code (single=1, tandem=2, tridem=3)

p_s = Terminal serviceability, $p_s = 2.0$ is assumed

$$G_s = f(p_s)$$

f_k = Value of f_k when L_s is equal to 18 and L_2 is equal to 1

D = Slab thickness in inches (Rigid pavements only)

P_v = Number of total design vehicle passes

Flexible Pavements:

$$G_t = \log \left(\frac{4.2 - p_k}{4.2 - 1.5} \right)$$

$$\beta_x = 0.40 + \frac{0.081 (L_x + L_2)^{3.23}}{(SN + 1)^{5.19} L_2^{3.23}}$$

$$\log \left(\frac{W_{18}}{W_{t18}} \right) = 4.79 \log(18 + 1) - 4.79 \log(L_x + L_2) + 4.33 \log(L_2) + \frac{G_t}{\beta_x} - \frac{G_t}{\beta_{18}}$$

Rigid Pavements:

$$G_t = \log \left(\frac{4.5 - p_t}{4.5 - 1.5} \right)$$

$$\beta_x = 1.00 + \frac{3.63 (L_x + L_2)^{5.20}}{(D + 1)^{8.46} L_2^{3.52}}$$

$$\log \left(\frac{W_{18}}{W_{t18}} \right) = 4.62 \log(18 + 1) - 4.62 \log(L_x + L_2) + 3.28 \log(L_2) + \frac{G_t}{\beta_x} - \frac{G_t}{\beta_{18}}$$

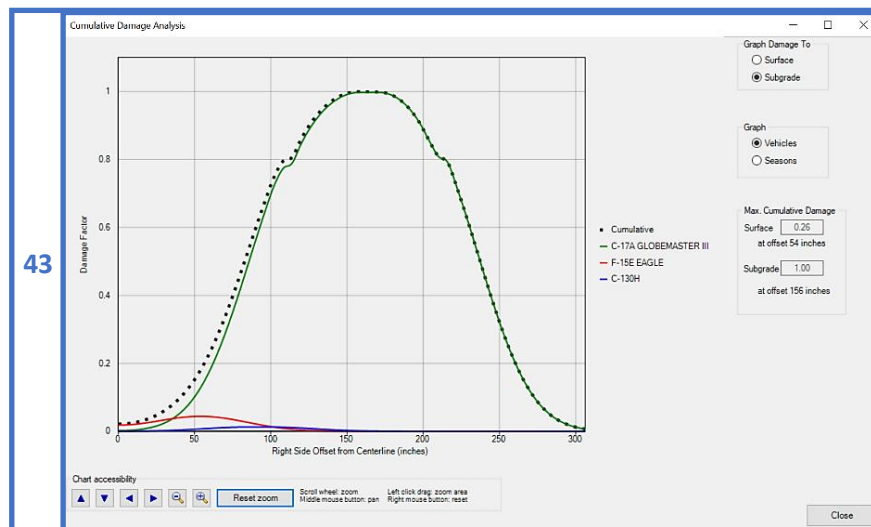
Sum of vehicle Equivalent Axle Loads Factors (EALF):

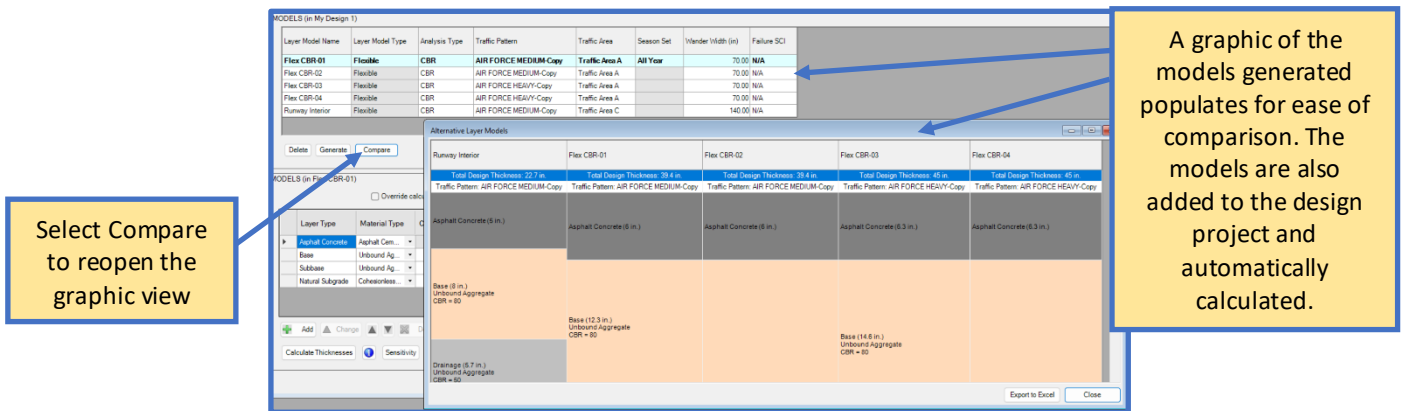
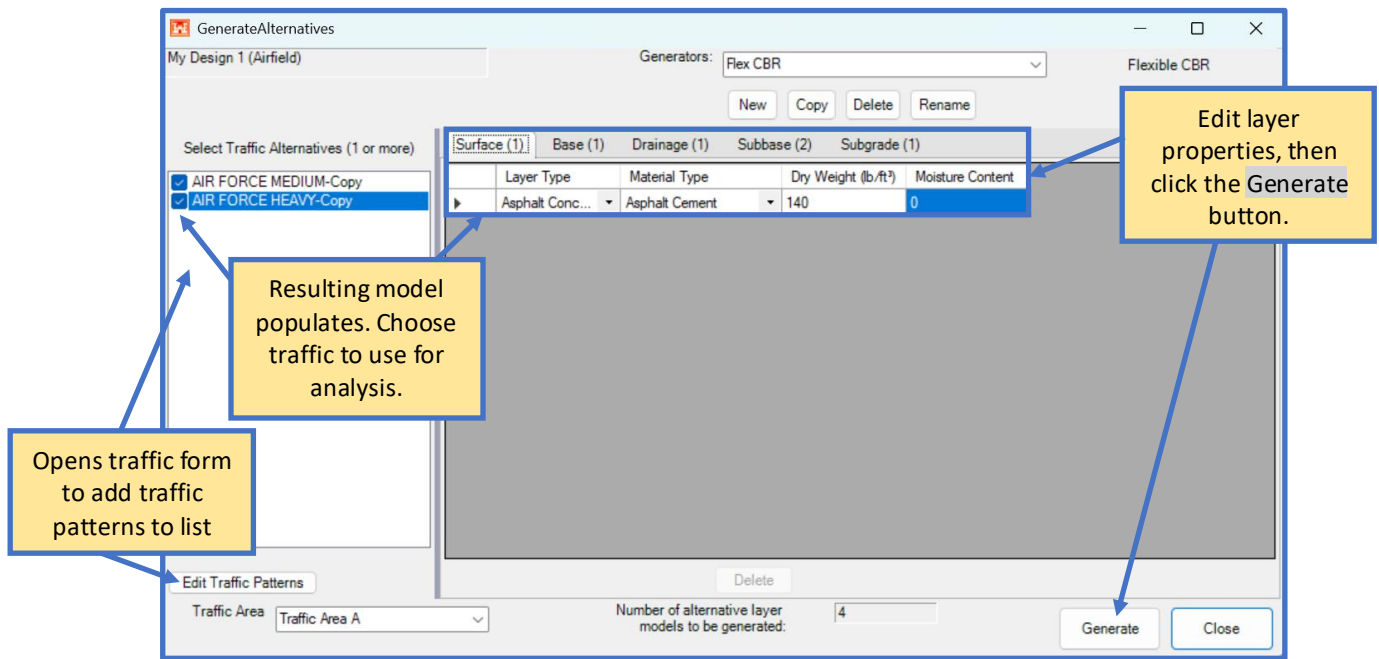
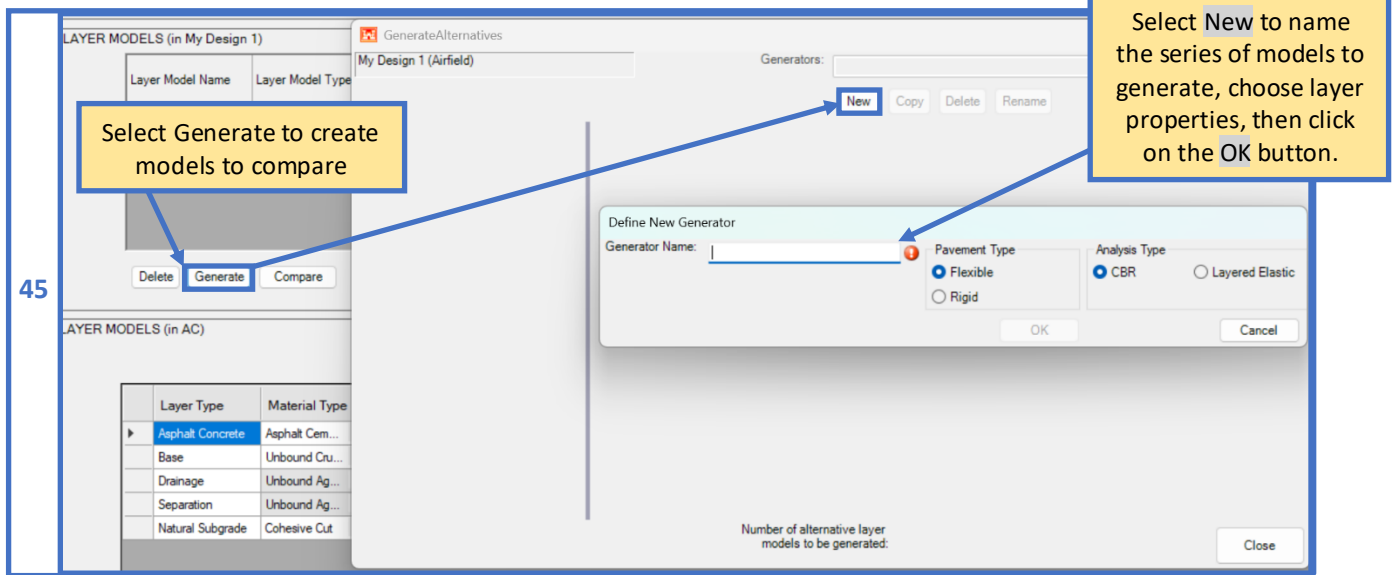
$$EALF = \sum \frac{W_{18}}{W_{t18}}$$

Vehicle ESAL:

$$ESAL = (EALF) P_v$$

Close





11.5 Design Examples

11.5.1 Flexible surfaced road using a new traffic pattern

Design a flexible road at an Army installation using the vehicles, weights and passes in Table 1 and material information in Table 2.

Table 1		
Ground Vehicle	Weight (lb)	Passes
Car – passenger	3,000	50,000
M977 HEMTT 10-Ton Cargo Truck 8x8	62,000	25,000
M998 HMMWV 1.25-Ton Carrier 4x4	7,900	75,000
M1078 2-1/2 Ton Cargo Truck 4x4	22,740	35,000
Truck 5 Axle	80,000	120,000

Table 2		
Layer	Description	Design CBR
Wearing surface	Asphalt Concrete (AC)	--
Base Course	GP (unbound aggregate)	80
Natural Subgrade	CH (cohesive cut)	6

The image shows two screenshots of a software interface. The top screenshot shows the 'Design - No Project' window with the 'Manage projects...' button highlighted. A blue arrow points from this button to the 'Create a new project' dialog box. In this dialog, the 'Project name' is 'Army Roads' and the 'Date' is 'Wednesday, November 25, 2020'. The 'Ok' button is highlighted with a blue box. A blue arrow points from the 'Ok' button to the 'Edit projects' dialog box. In the 'Edit projects' dialog, the 'Project' is 'Army Roads (11/25/2020)'. The 'Service' dropdown menu is open, showing options: 'Army', 'Air Force', 'Army', and 'Navy'. The 'Army' option is selected and highlighted with a blue box. The 'Designer Name' field is empty. There are checkboxes for 'Consider Frost' and 'Consider Drainage', both of which are unchecked.

Design - Project Army Roads

Project: Army Roads (11/25/2020) Manage projects... Project uses Army criteria Edit/Create Traffic Patterns Edit/Create Season Sets

Design Properties
Design: New Rename

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Compaction Traffic Class	Wander Width (in.)	Failure SCI
------------------	------------------	---------------	-----------------	--------------	------------	--------------------------	--------------------	-------------

Traffic

Patterns in Selected Project:

Create Import Standard

Vehicles Add

Create New Traffic Pattern

Pattern Name: Flex Rd traffic

Pavement Use: Roadway

Ok Cancel

Traffic

Patterns in Selected Project: Flex Rd Traffic

Create Delete Copy Rename Import Standard

Vehicles Add

Choose Vehicles

Vehicle Filter: Air Ground

- ☐ ATLAS 10000 LB CARRIAGE UNLOADED
- ☐ AXLE, 18 KIP
- ☐ B450 AIRCRAFT TOW TRACTOR
- ☐ B600 AIRCRAFT TOW TRACTOR
- ☐ B1200 AIRCRAFT TOW TRACTOR
- ☐ BLUE BIRD TYPE C BUS
- ☒ CAR - PASSENGER
- ☐ CMP 60 FORKLIFT
- ☐ COMBI-LIFT SC3T
- ☐ DROTT 650A1 C TRAVELIFT CRANE
- ☐ GENERATOR TRANSPORTER LOADED MULT PASS LEVE
- ☐ GILLIG LOW FLOOR BUS
- ☐ gr
- ☐ HRS-45-40-R
- ☐ HTC 86100
- ☐ JLG 60HT BOOM AERIAL LIFT
- ☐ JLG 60HTH BOOM AERIAL LIFT
- ☐ JLG 150HAX - ENGINE POWER BOOM W/AXLES EXTEND
- ☐ JLG 150HAX - ENGINE POWER BOOM W/AXLES RETRACT
- ☐ LSV, LIGHT STRIKE VEHICLE
- ☐ M-ATV (ASSAULT) 2-AXLE

Choose vehicle(s) by checking the box left of the vehicle name

Calculate Traffic OK Cancel

Select the vehicles shown below for the Flex RD Traffic pattern, then OK. Input Load and Passes as shown, then click Close on the Traffic form.

Traffic

Patterns in Selected Project: Flex Rd traffic

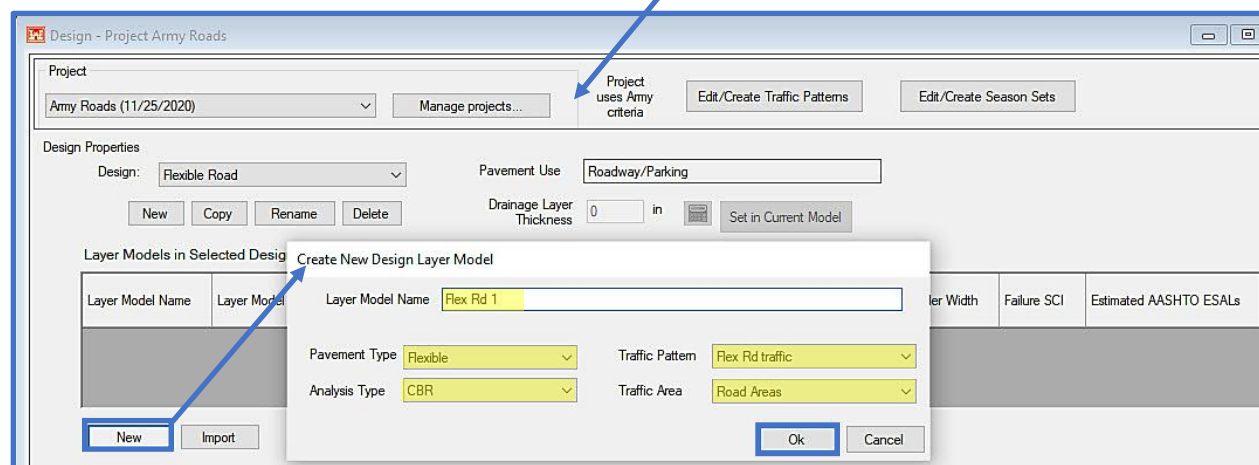
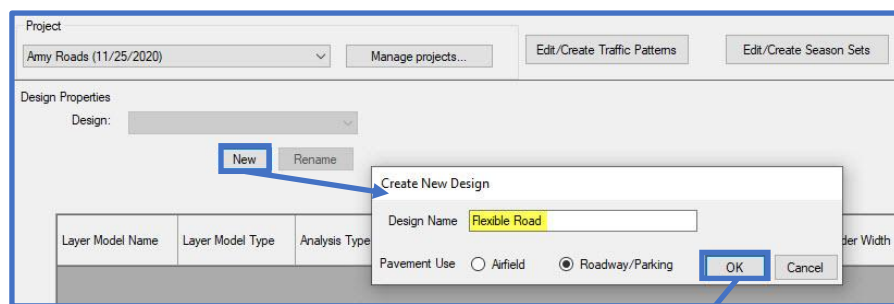
Import Standard

Pavement Use: Roadway

Vehicles Add Delete

Traffic	Load (lb)	Passes
CAR - PASSENGER	3,000	50,000
M977,HEMTT, 10-TON CARGO TRUCK, 8'8	62,000	25,000
M998, HMMWV, 1.25-TON CARRIER, 4X4	7,900	75,000
M1078 2-1/2 TON CARGO TRUCK 4 X 4	22,740	35,000
TRUCK, 5 AXLE	80,000	120,000

Close



PROJECT
Amy Roads (9/9/2026) Manage projects... Export All Designs Import Project uses Army criteria Edit/Create Traffic Patterns

DESIGN
Design: Flexible Road Pavement Use: Roadway/Parking
New Copy Rename Delete Export Design Drainage Layer Thickness: 0 in Set in Current Model

LAYER MODELS (in Flexible Road)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI	AASHTO ESALs
Flex Rd 1	Flexible	CBR	Flex Rd traffic	Road Areas	All Year	33.35	N/A	0

New Copy Import Delete Compaction Class: Roads Flexible

LAYERS (in Flex Rd 1)

Layer Type	Material Type	CBR	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)
Asphalt Concrete	Asphalt Cement		☒	3.00	3.00
Base	Unbound Aggregate	80	☒	4.00	4.00
Natural Subgrade	Cohesive Cut	6	☐		

Add Change Delete Compaction AASHTO ESALs View Traffic Pattern

Calculate Thicknesses M977 HEMTT, 10-TON CARGO TRUCK, 8" - 62,000 lb, 25,155 Passes

Design - Project Army Roads

PROJECT
Amy Roads (9/9/2026) Manage projects... Export All Designs Import Project uses Army criteria Edit/Create Traffic Patterns Edit/Create Season Sets Report

DESIGN
Design: Flexible Road Pavement Use: Roadway/Parking Design is for evaluating alternatives
New Copy Rename Delete Export Design Drainage Layer Thickness: 0 in Set in Current Model

LAYER MODELS (in Flexible Road)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI	AASHTO ESALs
Flex Rd 1	Flexible	CBR	Flex Rd traffic	Road Areas	All Year	33.35	N/A	428,822

New Copy Import Delete Compaction Class: Roads Flexible

LAYERS (in Flex Rd 1)

Layer Type	Material Type	CBR	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)
Asphalt Concrete	Asphalt Cement		☒	2.50	2.50
Base	Unbound Aggregate	80	☒	9.50	4.00
Natural Subgrade	Cohesive Cut	6	☐		

Add Change Delete Calculate Thicknesses Sensitivity Compaction AASHTO ESALs View Traffic Pattern

Compaction Requirements

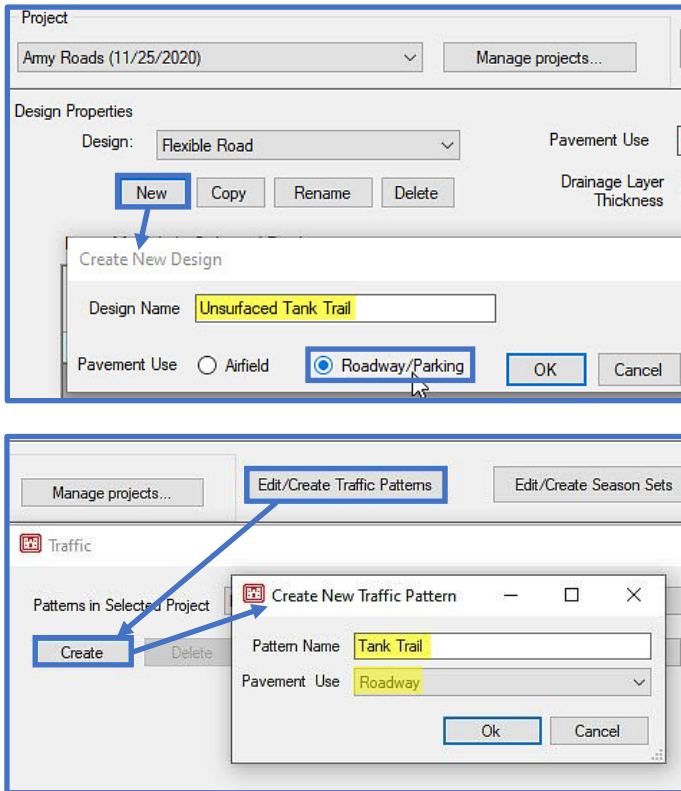
Compaction	Layer
12.0" - 100%	2.5" - Asphalt Concrete
9.5" - Base	
6.0" - 95%	Natural Subgrade
3.0" - 85%	

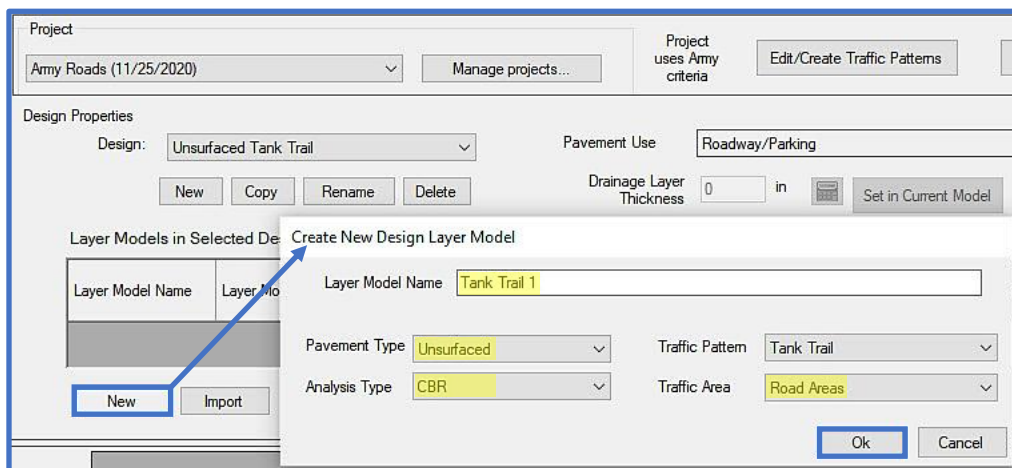
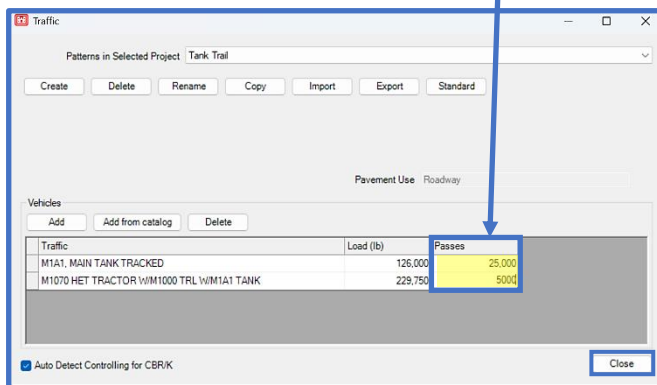
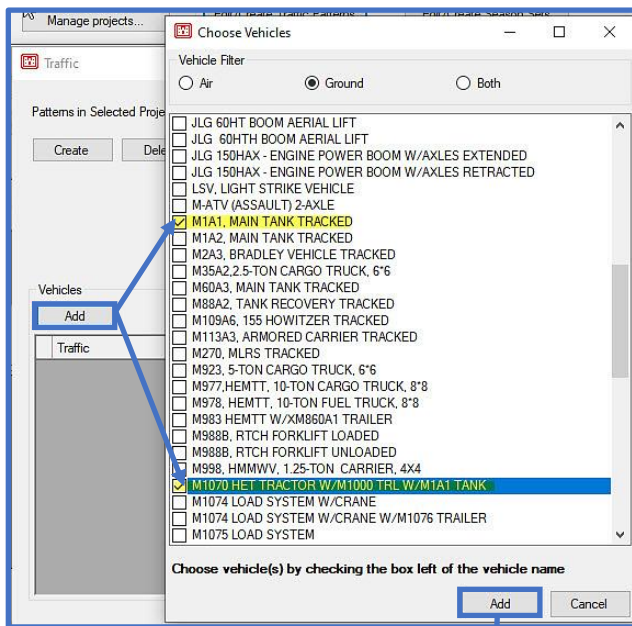
Remainder at natural compaction of 80 % Export to Excel Close

M977 HEMTT, 10-TON CARGO TRUCK, 8" - 62,000 lb, 25,155 Passes Close

11.5.2 Unsurfaced tank trail using a new traffic pattern

Design a CBR single layer aggregate surfaced (unsurfaced) tank trail for a 5-year life given 5,000 annual passes of the M1A1 and 1,000 annual passes of the M1070 Het Tractor W/M10000 TRL W/M1A1 (both at default weights). Use 80 CBR for the aggregate surface layer and 8 CBR for the subgrade.





DESIGN

Design: Unsurfaced Tank Trail Pavement Use: Roadway/Parking

New Copy Rename Delete Export Design

Drainage Layer Thickness: 0 in Set in Current Model

LAYER MODELS (in Unsurfaced Tank Trail)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI	AASHTO ESALs
Tank Trail 1	Unsurfaced	CBR	Tank Trail	Road Areas	All Year	33.35	N/A	0

New Copy Import Delete Compaction Class: Roads Unsurfaced

LAYERS (in Tank Trail 1)

Layer Type	Material Type	CBR	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)
Unsurfaced	Unbound Aggregate	80	☒	11.22	4.00
Natural Subgrade	Cohesive Cut	8	☐		

Add Change Delete Calculate Thicknesses View Traffic Pattern

MTA1, MAIN TANK TRACKED - 125,000 lb, 26,375 Passes

11.5.3 Mat surfaced airfield using a new traffic pattern

Design an AM-2 (medium duty) mat surfaced apron (traffic area A) by determining the required subbase thickness (assume 29 CBR) under the mat. The traffic includes 5,000 passes of the C-17 (585 kips) and 10,000 passes of the C-130J aircraft (155 kips). Use a natural subgrade CBR of 6.

Edit projects

Project: Amy Roads (9/9/2026) New Copy Rename Delete

Date: Thursday, September 10, 2026 Service: Army

Description: Create a new project

Designer Name: []

☐ Consider Frost ☐ Consider Drainage

Ok

Edit projects

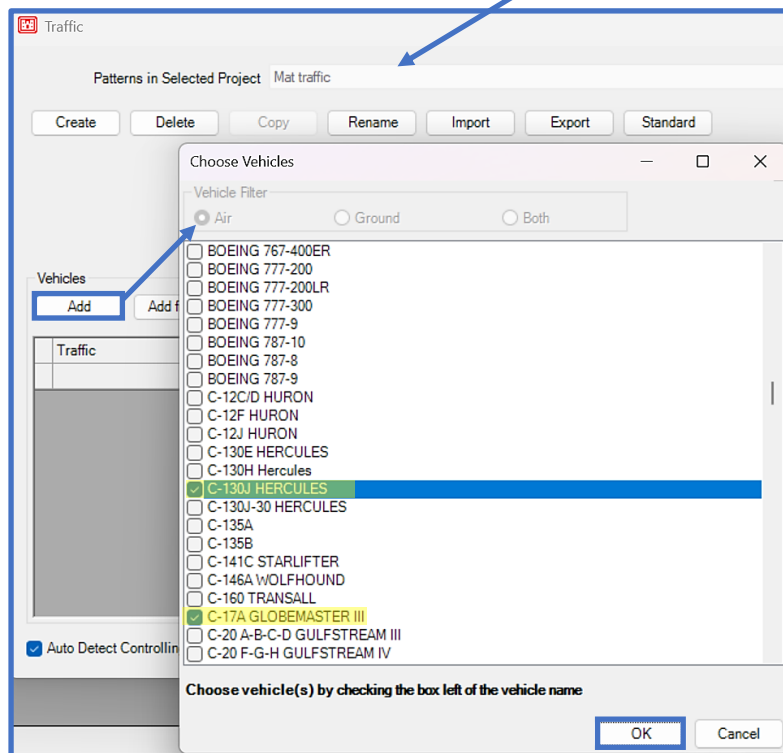
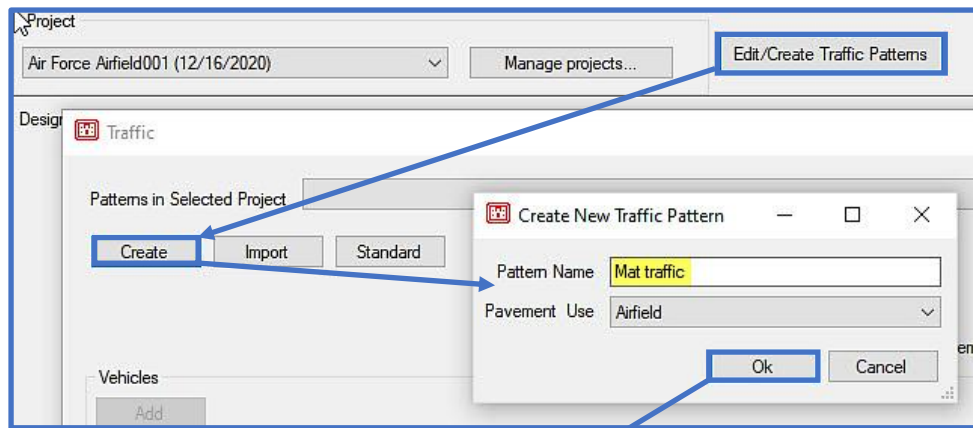
Project: Air Force Airfield (9/10/2026) New Copy Rename Delete

Date: Thursday, September 10, 2026 Service: Air Force

Description: [] Comments: []

Designer Name: []

☐ Consider Frost ☐ Consider Drainage



Traffic

Patterns in Selected Project: Mat traffic

Create Delete Copy Rename Import Export Standard

Pavement Use: Airfield

Vehicles

Add Add from catalog Delete ACN/ACR Curves

Traffic	Load (lb)	Areas A, B	Areas C, D	Areas A, B, C	Area D	Passes
C-17A GLOBEMASTER III	585,000	438,750	5,000	50		
C-130J HERCULES	155,000	116,250	10,000	100		

☒ Auto Detect Controlling for CBR/K

Project

Air Force Airfield (12/16/2020) Manage projects... Project uses Air Force criteria

Design Properties

Design:

Create New Design

Design Name:

Pavement Use: ☒ Airfield ☐ Roadway/Parking

Layer Models in Selected Design

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern

Create New Design Layer Model

Layer Model Name:

Pavement Type: Traffic Pattern:

Analysis Type: Traffic Area:

Mat designs are based on Traffic Area A only

LAYER MODELS (in Mat AF)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
Mat medium duty	Mat	CBR	Mat traffic	Traffic Area A	All Year	70.00	N/A

New Copy Import Delete

Compaction Class: Airfield Unsurfaced Class I

LAYERS (in Mat medium duty)

Layer Type	Material Type	CBR	Calculate	Non-Frost Design Thickness (in)	Min. Thickness (in)
Aluminum Mat	Medium Mat		☐		
Subbase	Unbound Aggregate	28.5	☒	4.00	4.00
Natural Subgrade	Cohesive Cut	6	☐		

Add Change Delete

Calculate Thicknesses

Compaction: C-17A GLOBEMASTER III - 585,000 lb, 5,015 Passes

The CBR below the Mat layer automatically defaults to the minimum required CBR to support the selected traffic when a layer model is initially created

Layer Type	Material Type	CBR	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)
Aluminum Mat	Medium Mat		☐		
Subbase	Unbound Aggregate	28.5	☒	24.83	4.00
Natural Subgrade	Cohesive Cut	6	☐		

11.5.4 Flexible surfaced airfield using standard traffic in a frost area

Design a new Primary Taxiway (type A traffic) at Offutt AFB (near Omaha), Nebraska for **Air Force Heavy** standard traffic and the material conditions given in the table below. Design for frost conditions. Drainage is required when designing for frost. The taxiway will be 75 feet wide and crowned in the middle, the transverse and longitudinal slopes will be 1%. The design will primarily involve subgrade cuts (for compaction requirements).

Layer	Description	Frost Code	Design CBR	Dry Unit Weight (pcf)	% Moisture
Wearing Surface	Asphalt Cement (AC)	F0	--	140	0
Base Course	Gravel (GP) Unbound aggregate	F0	80	135	5
Drainage Layer	Bank run sands Permeability = 1000 ft/day	F0	50	130	5
Separation Layer	Geotextile	--	--	--	--
Subbase Course	Gravel (GP)	F0	20	130	8
Natural Subgrade	Clay (CL), PI > 5	F3	6	100	18

Project

Offutt AFB (9/10/2026)

New

Copy

Rename

Delete

Date

Thursday, September 10, 2026

Service

Air Force

Description

Comments

Designer Name

☒ Consider Frost

☒ Consider Drainage

Climate Station

State or country

Station

Climate Information

Select Using Map

USA-Nebraska

Bellevue Offutt Afb

Drainage Station

State or country

Station

Drainage Information

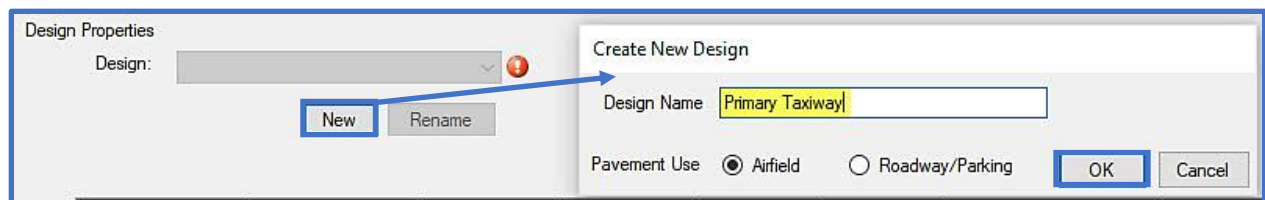
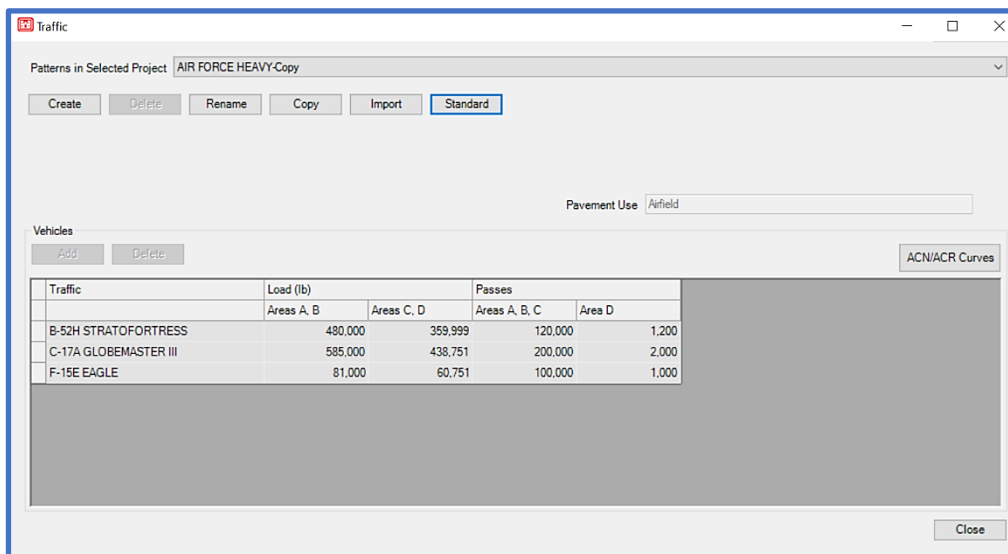
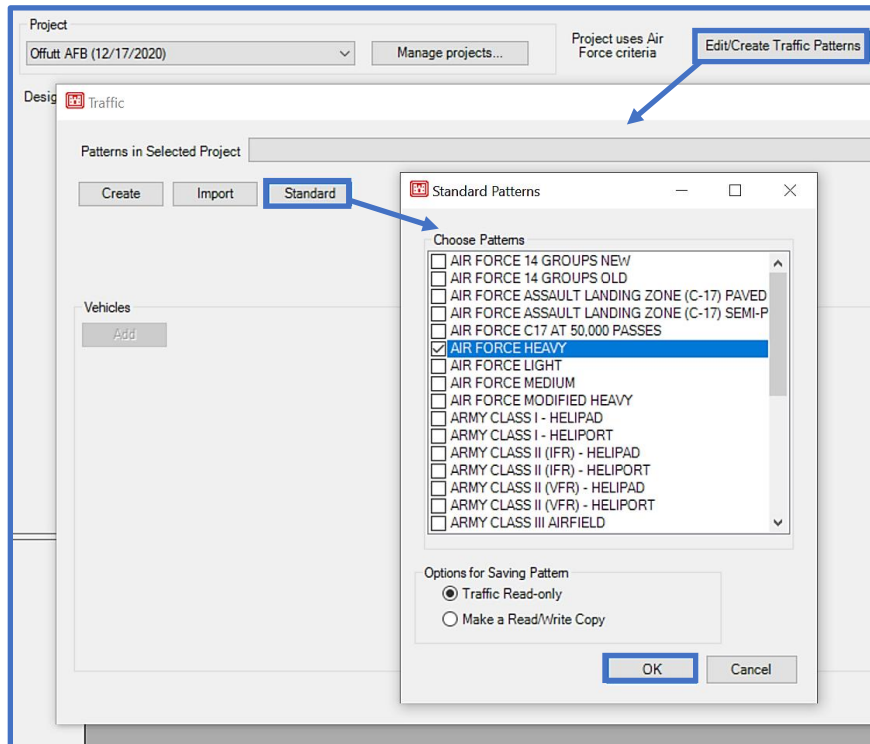
Select Using Map

USA-Nebraska

Omaha #1

Mark as historical

Close



Pavement Use:

Drainage Layer Thickness: in  Set in Current Model

Opens the Calculator for Drainage Thickness.

Drainage Layer Thickness Calculator

Input Parameters

Design Storm Index: (in./h)

Length of Drainage Path: (ft)

Slope of Drainage Path: (%)

Permeability of Drainage Material: (ft/day)

Effective Porosity:

Infiltration Coefficient:

Drainage Path Calculator

Drainage Path Properties

Length of Transverse Slope: (ft)

Transverse Slope: (%)

Longitudinal Slope: (%)

Calculate

Calculate Close

Note: Time for 85% drainage (T85) should be 1 day or less unless designing for a parking apron or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness.

Drainage Layer Thickness Calculator

Input Parameters

Design Storm Index: (in./h)

Length of Drainage Path: (ft)

Slope of Drainage Path: (%)

Permeability of Drainage Material: (ft/day)

Effective Porosity:

Infiltration Coefficient:

Results

Minimum Thickness: (in.)

Calculated Thickness: (in.)

Required Thickness: (in.)

Time for 85% Drainage: (days)

Note: Time for 85% drainage (T85) should be 1 day or less unless designing for a parking apron or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness.

Calculate Close

Layer Models in Selected Design

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Compaction Traffic Class	Wand

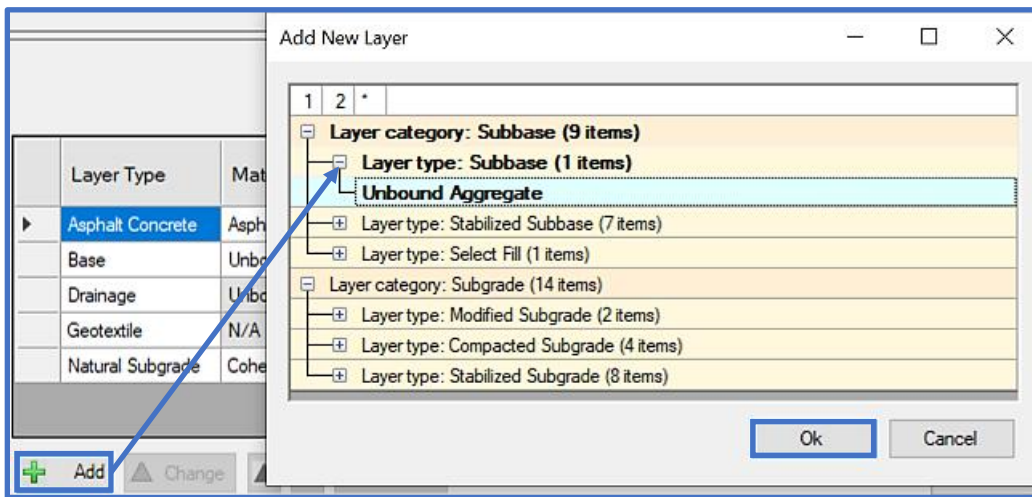
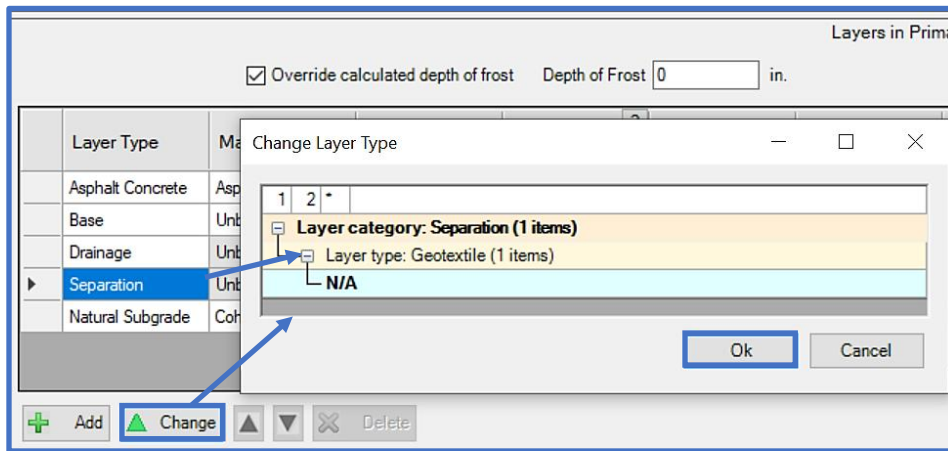
Create New Design Layer Model

Layer Model Name: ☒ Use Drainage Layer

Pavement Type: Traffic Pattern:

Analysis Type: Traffic Area:

Ok Cancel



LAYERS (in Primary TW Flexible 1)

☐ Override calculated depth of frost Depth of Frost 42 in

Layer Type	Material Type	CBR	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)
Asphalt Concrete	Asphalt Cement		NFS	0	140	☒	6.00	6.00	0.00	0.00
Base	Unbound Aggregate	80	NFS	5	135	☒	9.00	9.00	0.00	0.00
Drainage	Unbound Aggregate	50	NFS	5	130	☐	5.52	4.00	0.00	0.00
Geotextile	N/A		NFS			☐			0.00	0.00
✓ Subbase	Unbound Aggregate	20	NFS	5	130	☒	4.00	4.00	0.00	0.00
Natural Subgrade	Cohesive Cut	6	F3F4	18	100	☐				

+ Add ▲ Change ▼ Delete

Calculate Thicknesses

Subgrade Preparation Frost Design Selection Compaction

View Traffic Pattern

B-52H STRATOFORTRESS - 480,000 lb, 121,135 Passes

☐ Override calculated depth of frost Depth of Frost 49 in

Layer Type	Material Type	CBR	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft ³)	Calculate	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)
Asphalt Concrete	Asphalt Cement		NFS	0	140	☒	6.26	6.00	6.26	6.26
Base	Unbound Aggregate	80	NFS	5	135	☒	9.04	9.00	9.04	9.04
Drainage	Unbound Aggregate	50	NFS	5	130	☐	5.52	4.00	5.52	5.52
Geotextile	N/A		NFS			☐			0.00	0.00
Subbase	Unbound Aggregate	20	NFS	8	130	☒	24.15	4.00	42.45	24.15
Natural Subgrade	Cohesive Cut	6	F3F4	18	100	☐				

Calculation Result Information

Frost design thicknesses were requested but the frost depth doesn't reach frost-susceptible layers. RSS and LSFP results will therefore be the same as non-frost.

OK

View Traffic Pattern

B-52H STRATOFORTRESS - 480,000 lb, 121,135 Passes

The controlling design is highlighted

☐ Override calculated depth of frost Depth of Frost 48 in

Layer Type	Material Type	CBR	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft ³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)
Asphalt Concrete	Asphalt Cement		NFS	0	140	☐	6.50	6.00	6.50	6.50
Base	Unbound Aggregate	80	NFS	5	135	☒	9.00	9.00	9.00	9.00
Drainage	Unbound Aggregate	50	NFS	5	130	☐	6.00	4.00	6.00	6.00
Geotextile	N/A		NFS			☐			0.00	0.00
Subbase	Unbound Aggregate	20	NFS	8	130	☒	23.15	4.00	41.46	23.15
Natural Subgrade	Cohesive Cut	6	F3F4	18	100	☐				

View Traffic Pattern

B-52H STRATOFORTRESS - 480,000 lb, 121,135 Passes

Uncheck Compute to enter a new value

Round up the thicknesses in the non-frost column and recalculate to reduce the subbase thickness

Depth Of Subgrade Preparation

Reduced Subgrade Strength: in

Limited Subgrade Frost Penetration: in

OK

CompactionRequirements

Compaction	Layer
6.5" - Asphalt Concrete	Asphalt Concrete
9.0" - Base	Base
6.0" - Drainage	Drainage
44.7" - 100%	
23.2" - Subbase	Subbase
8.0" - 95%	
16.0" - 85%	Natural Subgrade

Remainder at natural compaction of %

Export to Excel Close

11.5.5 Rigid surfaced parking area using standard traffic in a frost area

Design a rigid Hardstand pavement for a Stryker Brigade Combat Team (BCT) Tactical Equipment Maintenance Facility (TEMF) at the Army reservation, Fort Drum, New York. Use the standard traffic pattern for this hardstand but change the M988B to the Loaded version. Design the Hardstand using the properties in the table below and keep the default settings for Modulus and Poisson's Ratios.

Layer	Description	Frost Code	Design K	Dry Unit Weight pcf	% Moisture
Wearing Surface	Portland Cement Concrete (PCC) Flex Strength = 650 psi	F0	--	145	0
Drainage Layer*	Uniform Graded Coarse Sand	F0	--	130	5
Separation Layer	Unbound aggregate	F0	--	130	8
Subgrade	SP Cohesionless Cut	F2	150	120	10

*Drainage Layer Parameters	
Precipitation Data	Ft. Drum
Length of transverse slope	800 ft
Transverse slope	1.50%
Longitudinal slope	1.50%
Permeability of drainage material	2,500 ft/day
Effective Porosity	0.25
Infiltration Coefficient	0.5

Manage projects... Export All Designs Import Project uses Air Force criteria Edit/Co

Edit projects

Project
Rt Drum (9/10/2026) New Copy Rename Delete

Date Thursday, September 10, 2026 Service Army

Description Comments

Designer Name

☒ Consider Frost ☒ Consider Drainage

Climate Station
State or country Station Climate Information
USA-New York Watertown International Airport Select Using Map

Drainage Station
State or country Station Drainage Information
USA-New York Rt Drum Select Using Map

Mark as historical Close

Project uses Army criteria Edit/Create Traffic Patterns Edit/Create Season Sets

Traffic

Patterns in Selected Project
Create Import Standard

Vehicles
Add

Standard Patterns

Choose Patterns

- ☐ ARMY CLASS III AIRFIELD
- ☐ ARMY CLASS IV <= 5000 FT (C-130)
- ☐ ARMY CLASS IV <= 5000 FT (C-17)
- ☐ ARMY CLASS IV > 5000 FT AND < 9000 FT
- ☐ ARMY CLASS V > 9000 FT
- ☐ ARMY CLASS V
- ☐ ARMY CLASS VI (C-130) PAVED LANDING ZONE
- ☐ ARMY CLASS VI (C-130) SEMIPREPARED LZ
- ☐ ARMY CLASS VI (C-17) PAVED LANDING ZONES
- ☐ ARMY CLASS VI (C-17) SEMIPREPARED LZ
- ☐ HARDSTAND HEAVY BCT TEMF
- ☐ HARDSTAND INFANTRY BCT TEMF
- ☒ HARDSTAND STRYKER BCT TEMF
- ☐ NAVY DESIGN TRAFFIC GROUP I
- ☐ NAVY DESIGN TRAFFIC GROUP II
- ☐ NAVY DESIGN TRAFFIC GROUP III

Options for Saving Pattern
☐ Traffic Read-only
☒ Make a Read/Write Copy

OK Cancel

Traffic

Patterns in Selected Project HARDSTAND STRYKER BCT TEMF-Editable Copy

Create Delete Copy Rename Import Export Standard

Rename Traffic Pattern

Pattern Name TAND STRYKER BCT TEMF-Loaded M988H Pavement Use Roadway

OK Cancel

Traffic	Load (lb)	Passes
M923, 5-TON CARGO TRUCK, 6'S	32,500	91,200
M977, HEMTT, 10-TON CARGO TRUCK, 8'S	62,000	105,600
M978, HEMTT, 10-TON FUEL TRUCK, 8'S	59,000	16,800
M988B, RTCH FORKLIFT UNLOADED	107,030	125
M998, HMMwV, 1.25-TON CARRIER, 4X4	7,900	160,800
TRUCK, 3 AXLE	35,000	9,600

Auto Detect Controlling for CBR/K Close

Traffic

Patterns in Selected Project: **HARDSTAND STRYKER BCT TEMF-Loaded M988B**

Create Delete Copy Rename Import Export Standard

Pavement Use: Roadway

Vehicles

Add Add from catalog Delete

Traffic	Load (lb)	Passes
M923, 5-TON CARGO TRUCK, 6*6	32,500	91,200
M977, HEMTT, 10-TON CARGO TRUCK, 8*8	62,000	105,600
M978, HEMTT, 10-TON FUEL TRUCK, 8*8	59,000	16,800
M988B, RTCH FORKLIFT UNLOADED	107,030	125
M988B, RTCH FORKLIFT LOADED	7,900	160,800
M988B, RTCH FORKLIFT UNLOADED	35,000	9,600
M998, HMMwV, 1.25-TON CARRIER, 4X4		
M-ATV (ASSAULT) 2-AXLE		
MC-130E COMBAT TALON I		
MC-130H COMBAT TALON II		
MC-130P COMBAT SHADOW		
MD-11		

Traffic

Patterns in Selected Project: **HARDSTAND STRYKER BCT TEMF-Loaded M988B**

Create Delete Rename Copy Import Export Standard

Pavement Use: Roadway

Vehicles

Add Add from catalog Delete

Traffic	Load (lb)	Passes
M923, 5-TON CARGO TRUCK, 6*6	32,500	91,200
M977, HEMTT, 10-TON CARGO TRUCK, 8*8	62,000	105,600
M978, HEMTT, 10-TON FUEL TRUCK, 8*8	59,000	16,800
M988B, RTCH FORKLIFT LOADED	163,160	125
M998, HMMwV, 1.25-TON CARRIER, 4X4	7,900	160,800
TRUCK, 3 AXLE	35,000	9,600

Update load and passes as shown

Design Properties

Design:

New Rename

Create New Design

Design Name: **Stryker Hardstand**

Pavement Use: ☐ Airfield ☒ Roadway/Parking

OK Cancel

Layer Models in Selected Design

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Compaction Traffic Class	Wander Width	F
New Create New Design Layer Model Layer Model Name PCC Hardstand Use Drainage Layer Pavement Type Rigid Traffic Pattern HARDSTAND STRYKER BCT TEMF-Loaded M988B Analysis Type K Traffic Area Parking Areas Ok Cancel								

Drainage Layer Thickness 0 in  Set in Current Model

Drainage Layer Thickness Calculator

Input Parameters

Design Storm Index 0.99 (in./h)

Length of Drainage Path (ft)

Slope of Drainage Path (%)

Permeability of Drainage Material (ft/day)

Effective Porosity

Infiltration Coefficient 0.5

Drainage Path Calculator

Drainage Path Properties

Length of Transverse Slope: 800 (ft)

Transverse Slope: 1.5 (%)

Longitudinal Slope: 1.5 (%)

Calculate

or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness.

Drainage Layer Thickness Calculator

Input Parameters

Design Storm Index 0.99 (in./h)

Length of Drainage Path 1,131 (ft)

Slope of Drainage Path 2.12 (%)

Permeability of Drainage Material 2500 (ft/day)

Effective Porosity 0.25

Infiltration Coefficient 0.5

Results

Minimum Thickness: 4 (in.)

Calculated Thickness: 2.32 (in.)

Required Thickness: 4 (in.)

Time for 85% Drainage: 5.33 (days)

Note: Time for 85% drainage (T85) should be 1 day or less unless designing for a parking apron or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness.

Calculate Close

☐ Override calculated depth of frost Depth of Frost 54 in

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)
	Portland Cement...	Portland Cem...	650			NFS	0	145
	Drainage	Unbound Ag...		0	229	NFS	5	130
►	Separation	Unbound Ag...		0	190	NFS	8	130
	Natural Subgrade	Cohesionless...		150	150	F2	10	120

LAYER MODELS (in Stryker Hardstand)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI	AASHTO ESALs
PCC Hardstand	Rigid	K	HARDSTAND STRYKER BCT TEMF-Loaded M988B	Parking Areas	All Year	33.35	N/A	1,214,002

New Copy Import Delete

PCC Surface Layer Properties
% Steel 0.00 Load Transfer % 25

Compaction Class Roads Rigid

LAYERS (in PCC Hardstand)

☐ Override calculated depth of frost: Depth of Frost 53 in

Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)	Modulus (psi)	Poisson's Ratio
Portland Cement	Portland Cem...	650			NFS	0	145	☒	10.12	6.00	12.51	10.12	4,000,000	0.15
Drainage	Unbound Ag...	0	0	229	NFS	5	130	☐	4.00	4.00	4.00	4.00		
Separation	Unbound Ag...	0	0	190	NFS	8	130	☐	4.00	4.00	4.00	27.47		
Natural Subgrade	Cohesionless...		150	150	F2	10	120	☐						

Add Change Delete

Calculate Thicknesses Sensitivity

Subgrade Preparation Frost Design Selection Compaction AASHTO ESALs

View Traffic Pattern Joints/Dowels

M988B, RTCH FORKJET LOADED - 163,160 lb, 130 Passes

Parking Areas increases the Load Transfer to 25%

LAYERS (in PCC Hardstand)

☐ Override calculated depth of frost: Depth of Frost 55 in

Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Calculate	Non-Frost Design Thickness (in)	Min. Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Frost Penetration (in)	Modulus (psi)	Poisson's Ratio
Portland Cement	Portland Cem...	650			NFS	0	145	☒	9.70	6.00	11.82	9.70	4,000,000	0.15
Drainage	Unbound Ag...	0	0	259	NFS	5	130	☐	4.00	4.00	4.00	4.00		
Separation	Unbound Ag...	0	0	226	NFS	8	130	☐	8.00	4.00	8.00	29.74		
Natural Subgrade	Cohesionless...		150	150	F2	10	120	☐						

Add Change Delete

Calculate Thicknesses Sensitivity

Frost Design Selection Subgrade Preparation Compaction AASHTO ESALs

View Traffic Pattern Joints/Dowels

M988B, RTCH FORKJET LOADED - 163,160 lb, 130 Passes

Adjust the separation layer thickness to reduce the PCC thickness, which creates a more economical design, then recalculate the layer model

Joint/Dowel Information

Joint/dowel information based on RSS PCC thickness

Joint Spacing: 15-20 ft.

Dowels

Spacing: 15 in.

Length: 20 in.

Diameter: 1-1.25 in.

OK

Depth Of Subgrade Preparation

Reduced Subgrade Strength: 13 in

Limited Subgrade Frost Penetration: 0 in

OK

CompactionRequirements

Compaction	Layer
11.8" - Portland Cement Concrete	
23.8" - 100%	
4.0" - Drainage	
8.0" - Separation	
6.0" - 95%	Natural Subgrade

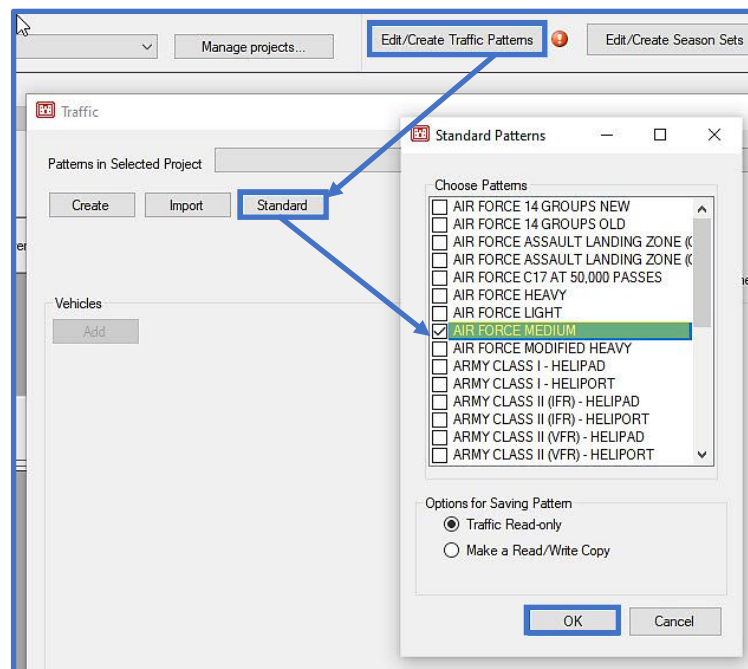
Remainder at natural compaction of 85 %

Export to Excel Close

11.5.6 Overlays for an existing rigid airfield pavement

An existing rigid apron (Traffic Area B) requires an overlay to support the Air Force Medium traffic. Design overlays (AC, PCC partially bonded and PCC unbonded) for the existing structure described in the table below. The apron is in poor condition (PCI=48) with 55% of the distresses due to load. Create a new design project for this exercise.

Layer	Thickness - inches	Flex Strength - psi	K- pci
Portland Cement Concrete (PCC)	12.0	700	--
Aggregate Base Course	6.0	--	--
Subgrade	--	--	150



Traffic	Load (lb)		Passes	
	Areas A, B	Areas C, D	Areas A, B, C	Area D
B-52H STRATOFORTRESS	400,000	300,001	400	4
C-17A GLOBEMASTER III	585,000	438,751	400,000	4,000
F-15E EAGLE	81,000	60,751	100,000	1,000

Design Properties

Design: Apron Overlays

New Rename

Create New Design

Design Name: Apron Overlays

Pavement Use: ☒ Airfield ☐ Roadway/Parking

OK Cancel

New Copy

Create New Design Layer Model

Layer Model Name: AC overlay ☐ Use Drainage Layer

Pavement Type: AC Overlay Over PCC Traffic Pattern: AIR FORCE MEDIUM-Copy

Analysis Type: K Traffic Area: Traffic Area B

Ok Cancel

DESIGN

Design: Apron Overlays Pavement Use: Airfield

New Copy Rename Delete Export Design

Drainage Layer Thickness: 0 in Set in Current Model

LAYER MODELS (in Apron Overlays)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
AC overlay	AC Overlay Over PCC	K	AIR FORCE MEDIUM-Copy	Traffic Area B	All Year	140.00	N/A

New Copy Import Delete

PCC Surface Layer Properties: Load Transfer %: 25

Existing PCC Condition Factors: C_b : 1.00 C_r : 1.00 ...

Compaction Class: Airfield Rigid ...

LAYERS (in AC overlay)

Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Compute	Non-Frost Design Thickness (in)	Min Thickness (in)	Modulus (psi)	Poisson's Ratio
Asphalt Overlay	Asphalt Cement				☒	6.00	3.00		
Portland Cement...	Portland Cement	700			☐	12.00	4.00	4,000,000	0.15
Base	Unbound Aggregate		0	190	☐	5.00	4.00		
Natural Subgrade	Cohesive Cut		150	150	☐				

+ Add ▲ Change ▼ ✖ Delete

Calculate Thicknesses ...

View Traffic Pattern View F Factors Passes

Existing PCC Condition Calculator

Input Parameters:

☒ Enter PCI and % Load Distress

PCI: 48

% Load Distress: 55

☐ Enter SCI

SCI: 71.40

Calculate

Results:

SCI: 71.40

C_b : 0.89

C_r : 0.75

Close

LAYER MODELS (in Apron Overlays)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
AC overlay	AC Overlay Over PCC	K	AIR FORCE MEDIUM-Copy	Traffic Area B	All Year	140.00	N/A

New Copy Import Delete

PCC Surface Layer Properties
Load Transfer % 25

Existing PCC Condition Factors
C_s : 0.89 C_r : 0.75

Compaction Class
Airfield Rigid

Condition factors are saved for subsequent layer models in a design

LAYERS (in AC overlay)

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Calculate	Non-Frost Design Thickness (in)	Min. Thickness (in)	Modulus (psi)	Poisson's Ratio
▶	Asphalt Overlay	Asphalt Cement				☒	7.56	3.00		
	Portland Cement...	Portland Cement	700			☐	12.00	4.00	4,000,000	0.15
	Base	Unbound Aggregate		0	208	☐	6.00	4.00		
	Natural Subgrade	Cohesive Cut		150	150	☐				

LAYER MODELS (in Apron Overlays)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width
AC overlay	AC Overlay Over PCC	K	AIR FORCE MEDIUM-Copy	Traffic Area B	All Year	

Create New Design Layer Model

Layer Model Name PCC overlay over PCC

Pavement Type PCC Overlay Over PCC Traffic Pattern AIR FORCE MEDIUM-Copy

Analysis Type K Traffic Area Traffic Area B

New Copy

Ok Cancel

LAYERS (in AC overlay)

New Copy Import Delete

PCC Surface Layer Properties
% Steel 0.00 Load Transfer % 25

Existing PCC Condition Factors
C_s : 0.89 C_r : 0.75

Compaction Class
Airfield Rigid

LAYERS (in PCC overlay over PCC)

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Modulus (psi)	Poisson's Ratio
▶	PCC Partially Bonded Overlay	Portland Cement	700			☒	6.00	6.00	4,000,000	0.15
	Portland Cement...	Portland Cement	700			☐	12.00	4.00	4,000,000	0.15
	Base	Unbound Aggregate		0	190	☐	6.00	4.00		
	Natural Subgrade	Cohesive Cut		150	150	☐				

Add Change Delete

Calculate Thicknesses

Compaction

View Traffic Pattern

C-17A GLOBEMASTER III - 589

Update the values highlighted in yellow then Calculate Thicknesses

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Modulus (psi)	Poisson's Ratio
▶	PCC Partially Bonded Overlay	Portland Cement	700			☒	8.45	6.00	4,000,000	0.15
	Portland Cement Concrete	Portland Cement	700			☐	12.00	4.00	4,000,000	0.15
	Base	Unbound Aggregate		0	208	☐	6.00	4.00		
	Natural Subgrade	Cohesive Cut		150	150	☐				

Add Change Delete

Calculate Thicknesses

Compaction

View Traffic Pattern View F Factors Joints/Dowels

C-17A GLOBEMASTER III - 585,000 lb, 428,468 Passes

11.5.7 Airfield shoulder pavement

Design a rigid shoulder pavement using the properties in the table below and the default settings for Modulus and Poisson's Ratios.

Layer	Thickness - inches	Flex Strength - psi	K- pci
Portland Cement Concrete (PCC)		650	--
Aggregate Base Course	6.0	--	--
Subgrade	--	--	150

The following steps illustrate the process of creating a new airfield shoulder design in the software:

- Edit projects:** Select the project "Airfield Shoulders (9/11/2026)" and click **New**.
- Edit/Create Traffic Patterns:** Click **Standard** to choose a pattern. Select **AIRFIELD SHOULDER RIGID-COPY** from the list of patterns.
- Create New Design:** Click **New** to create a new design. Set the **Design Name** to "Airfield Shoulders", select **Airfield** for **Pavement Use**, and click **OK**.
- Create New Design Layer Model:** Click **New** to create a new layer model. Set the **Layer Model Name** to "Rigid AF Shoulder", select **Shoulders Rigid** for **Pavement Type**, select **AIRFIELD SHOULDER RIGID-COPY** for **Traffic Pattern**, select **K** for **Analysis Type**, and click **OK**.

LAYER MODELS (in Airfield Shoulders)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
Rigid AF Shoulder	Shoulders Rigid	K	AIRFIELD SHOULDER RIGID-Copy	Traffic Area A	All Year	70.00	N/A

New Copy Import Delete

PCC Surface Layer Properties
 % Steel 0.00 Load Transfer % 25
 Compaction Class Airfield Rigid

LAYERS (in Rigid AF Shoulder)

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Modulus (psi)	Poisson's Ratio
▶	Portland Cement...	Portland Cement	650			☒	6.00	6.00	4,000,000	0.15
	Base	Unbound Aggregate		0	190	☐	6.00	4.00		
	Natural Subgrade	Cohesionless Cut		150	150	☐				

Add Change Delete

Calculate Thicknesses View Traffic Pattern

Update the values highlighted in yellow as shown and Calculate Thicknesses

LAYERS (in Rigid AF Shoulder)

	Layer Type	Material Type	Flex. Strength (psi)	K (pci)	Eff. K (pci)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Modulus (psi)	Poisson's Ratio
▶	Portland Cement...	Portland Cement	650			☒	6.09	6.00	4,000,000	0.15
	Base	Unbound Aggregate		0	208	☐	6.00	4.00		
	Natural Subgrade	Cohesionless Cut		150	150	☐				

Add Change Delete

Calculate Thicknesses Sensitivity View Traffic Pattern Joints/Dowels

11.5.8 Flexible surfaced airfield using Layered Elastic Design; one season

Design a flexible primary taxiway at Fort Polk, Louisiana, using the traffic in Table 1 and material information in Table 2.

Table 1 – Polk Airfield Traffic		
Vehicle	Weight (lb)	Passes
C-17A	585,000	5,500
C-130H	155,000	10,500
F-15E	81,000	29,000

Table 2				
Layer	Description	Modulus (psi)	Poisson's Ratio	Bond
Wearing Surface	Asphalt Concrete (AC)	350,000	0.35	Fully Bonded
Base Course	Unbound aggregate	60,000	0.35	Fully Bonded
Drainage Layer*	Unbound aggregate	45,000	0.35	Fully Bonded
Separation Layer	Geotextile	--	--	--
Natural Subgrade	CH (cohesive cut)	20,000	0.40	0

*Drainage Layer Parameters	
Precipitation Data	Leesville, LA
Length of transverse slope	100 ft
Transverse slope	1.50%
Longitudinal slope	1.00%
Permeability of drainage material	2,200 ft/day
Effective Porosity	0.3
Infiltration Coefficient	0.5

Manage projects... Edit/Create Traffic Patterns Edit/Create Season Sets

Edit projects

Project: Fort Polk (1/6/2021) New Copy Rename Delete

Date: Wednesday, January 06, 2021 Service: Army

Description: Comments:

Designer Name:

☐ Consider Frost

☒ Consider Drainage

Drainage station: State or country: USA-Louisiana Weather station: Leesville Drainage Information

Manage projects... Edit/Create Traffic Patterns Edit/Create

Traffic

Patterns in Selected Project: Create Import Standard

Create New Traffic Pattern

Pattern Name: Polk Airfield Traffic

Pavement Use: Airfield

Ok Cancel

Traffic

Patterns in Selected Project: Polk Airfield Traffic

Create Delete Copy Rename Import Standard

Choose Vehicles

Vehicle Filter: ☒ Air ☐ Ground ☐ Both

Vehicles: Add

☐ C-121 HURON
☒ C-17A GLOBEMASTER III
☐ C-20 A-B-C-D GULFSTREAM III
☐ C-20 F-G-H GULFSTREAM IV
☐ C-21A GATES LEARJET 35
☐ C-22B
☐ C-23
☐ C-27
☐ C-27J SPARTAN
☐ C-32A/B
☐ C-37A GULFSTREAM V
☐ C-38A COURIER
☐ C-40A CLIPPER
☐ C-40B/C
☐ C-41A CASA 212
☐ C-130-J HERCULES
☐ C-130E HERCULES
☒ C-130H
☐ C-130J-30 HERCULES
☐ C-135A
☐ C-135B
☐ C-141C STARLIFTER
☐ C-146A WOLFHOUD
☐ C-160 TRANSALL
☐ C-295 CASA
☐ CANBERRA B MK6-PR MK7-B MK8

Choose vehicle(s) by checking the box left of the vehicle name

Add Cancel

Traffic

Patterns in Selected Project: Polk Airfield Traffic

Create Delete Rename Copy Import Standard

Pavement Use: Airfield

Vehicles: Add Delete

ACN/ACR Curves

Traffic	Load (lb)	Passes		
		Areas A, B	Areas C, D	Areas A, B, C
C-17A GLOBEMASTER III	585,000	438,751	5,500	55
C-130H	155,000	116,250	10,500	105
F-15E EAGLE	81,000	60,751	29,000	290

Close

Design Properties

Design:

New Rename

Create New Design

Design Name Primary Taxiway

Pavement Use ☒ Airfield ☐ Roadway/Parking

OK Cancel

Delete Drainage Layer Thickness 0 in Set in Current Model

Type	Traffic Pattern	Traffic Area	Season Set	Compaction Traffic Class	Wander Width (in.)	Failure SCI
Drainage Layer Thickness Calculator Input Parameters Design Storm Index 2.06 (in./h) Length of Drainage Path (ft) Slope of Drainage Path (%) Permeability of Drainage Material 0 (ft/day) Effective Porosity 0.00 Infiltration Coefficient 0.5 Results Minimum Thickness: (in.) Calculated Thickness: (in.) Required Thickness: (in.) Time for 85% Drainage: (days) Note: Time for 85% drainage (T85) should be 1 day or less unless designing for a parking apron or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness. Calculate Close						

Drainage Path Calculator

Drainage Path Properties

Length of Transverse Slope: 100.0 (ft)

Transverse Slope: 1.50 (%)

Longitudinal Slope: 1.00 (%)

Calculate

Drainage Layer Thickness Calculator

Input Parameters

Design Storm Index 2.06 (in./h)

Length of Drainage Path 120 (ft)

Slope of Drainage Path 1.80 (%)

Permeability of Drainage Material 2200 (ft/day)

Effective Porosity 0.3

Infiltration Coefficient 0.5

Results

Minimum Thickness: 4 (in.)

Calculated Thickness: 3.93 (in.)

Required Thickness: 4 (in.)

Time for 85% Drainage: 0.91 (days)

Note: Time for 85% drainage (T85) should be 1 day or less unless designing for a parking apron or other areas of low volume and slow moving traffic, then T85 < 10 days. T85 is not a function of thickness.

Calculate Close

Layer Models in Selected Design

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Compaction Traffic Class
Create New Design Layer Model Layer Model Name Flexible Primary Taxiway LED ☒ Use Drainage Layer Pavement Type Flexible Analysis Type Layered Elastic Traffic Pattern Polk Airfield Traffic Traffic Area Traffic Area A Ok Cancel						

New

Modulus values were given therefore Layered Elastic is the Analysis Type

LAYER MODELS (in Primary Taxiway)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI
Flexible Primary Taxiway LED	Flexible	LED	Polk Airfield Traffic	Traffic Area A	All Year	70.00	50

New Copy Import Delete

Compaction Class
Army Class IV Runway > 5.0

The Polk Airfield Traffic mix has a C-17 therefore the "Class IV airfield with a runway greater than 9,000 ft", which also contains the C-17, is selected for the Compaction Traffic Class

New Copy Import

Change Layer Type

Values for season 1 of All Year

Layer Type	Material Type	Modulus (psi)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Poisson's Ratio	Bond
Asphalt Concrete	Asphalt Cement	350,000	☒	5.00	5.00	0.45	Fully Bonded
Base	Unbound Aggregate	60,000	☒	6.00	6.00	0.35	Fully Bonded
Drainage	Unbound Aggregate	45,000	☐	4.00	4.00	0.35	Fully Bonded
Separation	Unbound Aggregate	45,000	☐	4.00	4.00	0.35	Fully Bonded
Natural Subgrade	Cohesive Cut	20,000	☐			0.40	

Ok Cancel

+ Add Change - Delete

Compaction Class

Change the moduli values highlighted in yellow then Calculate Thicknesses

LAYERS (in Flexible Primary Taxiway LED)

Values for season 1 of All Year

Layer Type	Material Type	Modulus (psi)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Poisson's Ratio	Bond
Asphalt Concrete	Asphalt Cement	350,000	☒	5.00	5.00	0.45	Fully Bonded
Base	Unbound Aggregate	60,000	☒	6.00	6.00	0.35	Fully Bonded
Drainage	Unbound Aggregate	45,000	☐	4.00	4.00	0.35	Fully Bonded
Geotextile	N/A		☐				
Natural Subgrade	Cohesive Cut	20,000	☐			0.40	

+ Add Change - Delete

Calculate Thicknesses Stress/Strain

Compaction View Traffic Pattern Damage

LAYERS (in Flexible Primary Taxiway LED)

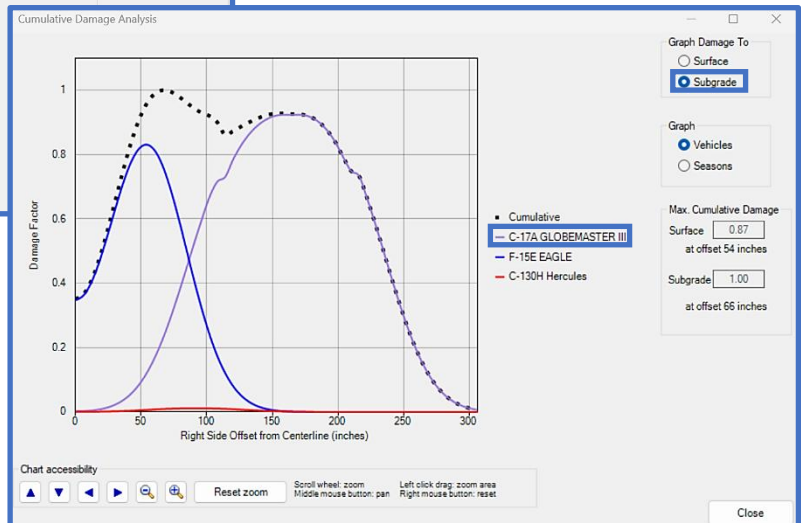
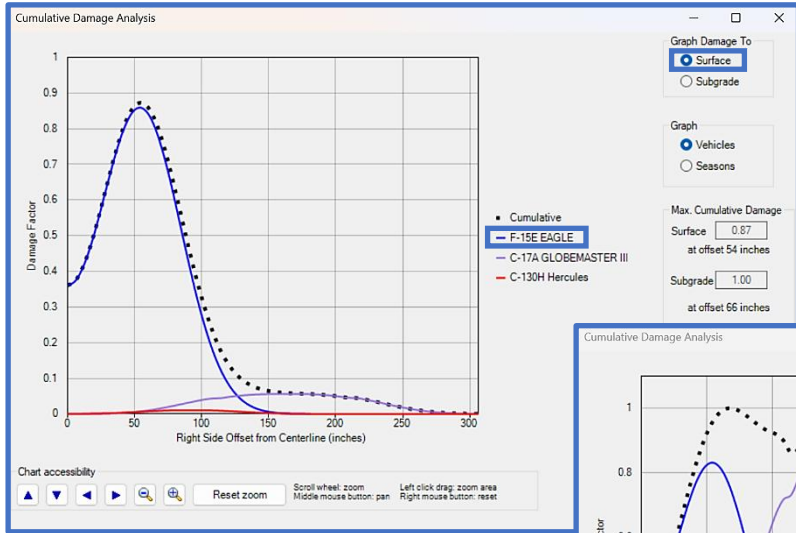
Values for season 1 of All Year

Layer Type	Material Type	Modulus (psi)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Poisson's Ratio	Bond
Asphalt Concrete	Asphalt Cement	350,000	☒	5.00	5.00	0.45	Fully Bonded
Base	Unbound Aggregate	60,000	☒	8.63	6.00	0.35	Fully Bonded
Drainage	Unbound Aggregate	45,000	☐	4.00	4.00	0.35	Fully Bonded
Geotextile	N/A		☐				
Natural Subgrade	Cohesive Cut	20,000	☐			0.40	

Compaction	Layer
	5.0" - Asphalt Concrete
17.6" - 100%	8.6" - Base
	4.0" - Drainage
11.0" - 95%	Natural Subgrade

Remainder at natural compaction of 90 %

Export to Excel Close



11.5.9 Rigid surfaced parking area using Layered Elastic Design; multiple seasons

Design a rigid hardstand pavement for a Stryker Brigade Combat Team (BCT) Tactical Equipment Maintenance Facility (TEMF) at the Army reservation, Fort Drum, New York. Use the standard traffic pattern for this hardstand but change the M988B to the Loaded version. Design the rigid pavement with a flexural strength of 650 psi and the 4.0-inch drainage layer with a 4-inch aggregate separation layer. Since frost penetration is a concern, create multiple seasons and enter the modulus values and Poisson's Ratio given in the table below for each season to account for freezing and thawing conditions. Open the Ft. Drum design project from example 11.5.5.

Material	Season 1		Season 2		Season 3	
	Nov – Feb		Mar – May		Jun - Oct	
	E (psi)	v	E (psi)	v	E (psi)	v
PCC	4,000,000	0.15	4,000,000	0.15	4,000,000	0.15
Drainage	45,000	0.35	45,000	0.35	45,000	0.35
Separation	45,000	0.35	45,000	0.35	45,000	0.35
Subgrade	25,000	0.40	8,000	0.40	16,100	0.40

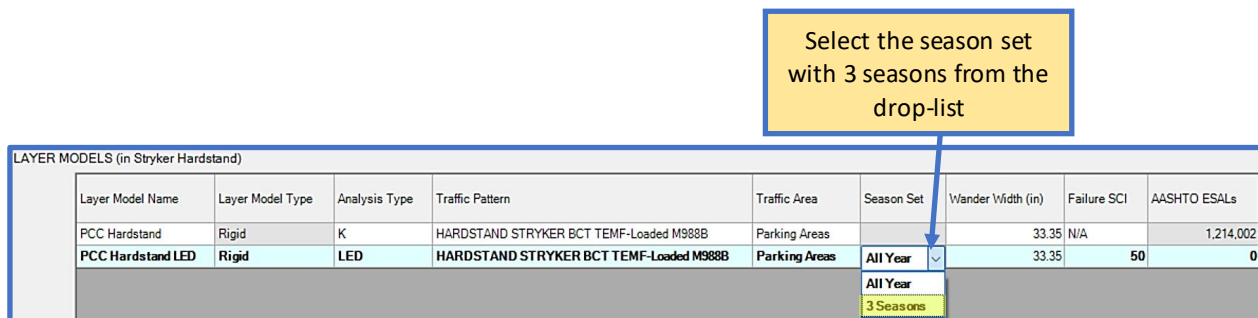
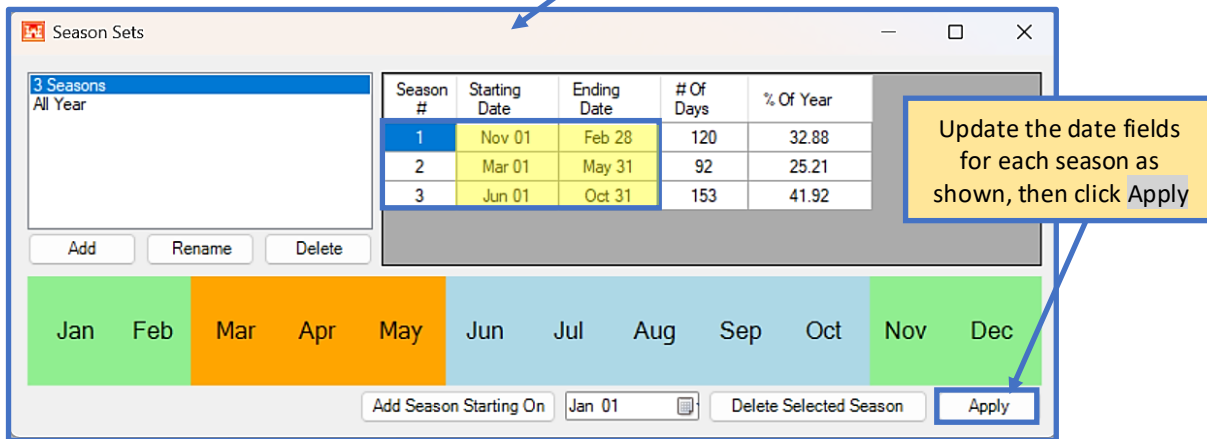
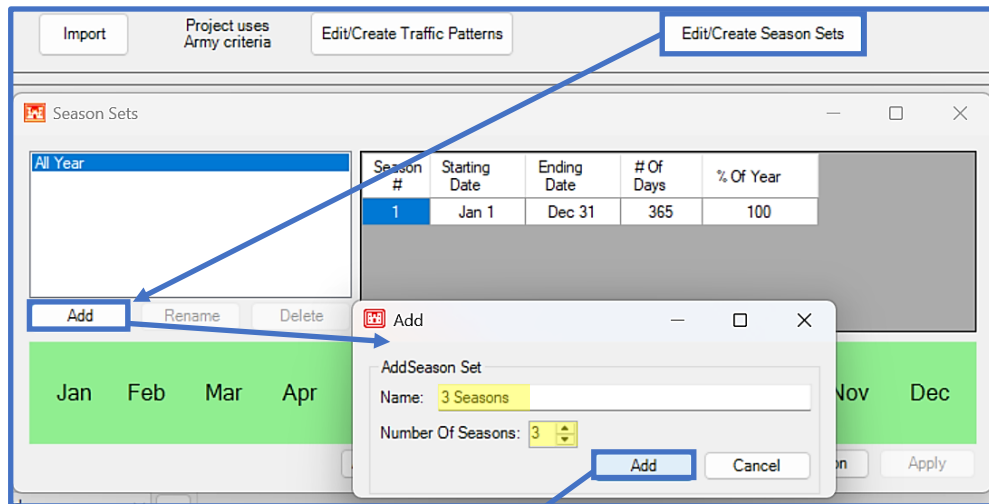
The screenshot shows the software interface for creating a new design layer model. The 'Create New Design Layer Model' dialog box is open, displaying the following settings:

- Layer Model Name:** PCC Hardstand LED
- Use Drainage Layer:** ☒
- Pavement Type:** Rigid
- Analysis Type:** Layered Elastic
- Traffic Pattern:** HARDSTAND STRYKER BCT TEMF-Loaded M988B
- Traffic Area:** Parking Areas

The 'Layer Models in Selected Design' table is visible in the background, showing the following data:

Layer Model Name	Layer Model Type	Analysis Type
PCC Hardstand	Rigid	K

The 'New' button in the 'Layer Models in Selected Design' table is highlighted with a blue box, and an arrow points from it to the 'Create New Design Layer Model' dialog box.



For each season,
enter the appropriate
Modulus values

Update the Moisture
Content and Dry Unit
Weight values as shown

LAYERS (in PCC Hardstand LED)

Depth of Frost 46 in

Values for season 1 of 3 Seasons

Layer Type	Material Type	Flex. Strength (psi)	Modulus (psi)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Calculate	Non-Frost Design Thickness (in)	Min. Thickness (in)	Poisson's Ratio	Bond
Portland Cement...	Portland Cement	650	4,000,000	NFS	0	145	☒	8.00	6.00	0.15	Partially Bon...
Drainage	Unbound Aggregate		45,000	NFS	5	130	☐	4.00	4.00	0.35	Fully Bonded
Separation	Unbound Aggregate		45,000	NFS	8	130	☐	4.00	4.00	0.35	Fully Bonded
Natural Subgrade	Cohesive Cut		25,000	F3F4	10	120	☐			0.40	

Depth of Frost 46 in

Values for season 2 of 3 Seasons

Layer Type	Material Type	Flex. Strength (psi)	Modulus (psi)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute
Portland Cement...	Portland Cement	650	4,000,000	NFS	0	145	☒
Drainage	Unbound Aggregate		45,000	NFS	5	130	☐
Separation	Unbound Aggregate		45,000	NFS	8	130	☐
Natural Subgrade	Cohesive Cut		8,000	F3F4	10	120	☐

Depth of Frost 46 in

Values for season 3 of 3 Seasons

Layer Type	Material Type	Flex. Strength (psi)	Modulus (psi)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute
Portland Cement...	Portland Cement	650	4,000,000	NFS	0	145	☒
Drainage	Unbound Aggregate		45,000	NFS	5	130	☐
Separation	Unbound Aggregate		45,000	NFS	8	130	☐
Natural Subgrade	Cohesive Cut		16,100	F3F4	10	120	☐

LAYER MODELS (in Stryker Hardstand)

Layer Model Name	Layer Model Type	Analysis Type	Traffic Pattern	Traffic Area	Season Set	Wander Width (in)	Failure SCI	AASHTO ESALs
PCC Hardstand	Rigid	K	HARDSTAND STRYKER BCT TEMF-Loaded M988B	Parking Areas		33.35	N/A	1,214,002
PCC Hardstand LED	Rigid	LED	HARDSTAND STRYKER BCT TEMF-Loaded M988B	Parking Areas	3 Seasons	33.35	50	1,215,468

New Copy Import Delete

PCC Surface Layer Properties

% Steel 0.00

Load Transfer % 25

Compaction Class

Roads Rigid

LAYERS (in PCC Hardstand LED)

Depth of Frost 53 in

Values for season 3 of 3 Seasons

Layer Type	Material Type	Flex. Strength (psi)	Modulus (psi)	Frost Code	Moisture Content %	Dry Unit Weight (lb/ft³)	Compute	Non-Frost Design Thickness (in)	Min. Thickness (in)	Poisson's Ratio	Bond
Portland Cement...	Portland Cement	650	4,000,000	NFS	0	145	☒	9.72	6.00	0.15	Partially Bon...
Drainage	Unbound Aggregate		45,000	NFS	5	130	☐	4.00	4.00	0.35	Fully Bonded
Separation	Unbound Aggregate		45,000	NFS	8	130	☐	4.00	4.00	0.35	Fully Bonded
Natural Subgrade	Cohesive Cut		16,100	F3F4	10	120	☐			0.40	

Add Change Delete

Calculate Thicknesses Stress/Strain

Subgrade Preparation Compaction AASHTO ESALs

View Traffic Pattern Joints/Dowels Damage

Compaction	Layer
17.7" - 100%	9.7" - Portland Cement Concrete
	4.0" - Drainage
	4.0" - Separation

Remainder at natural compaction of %

* - Because natural compaction is $\geq 90\%$ of maximum, no compaction necessary other than the required to provide a smooth surface.

Joint/Dowel Information

Joint/dowel information based on non-frost PCC thickness

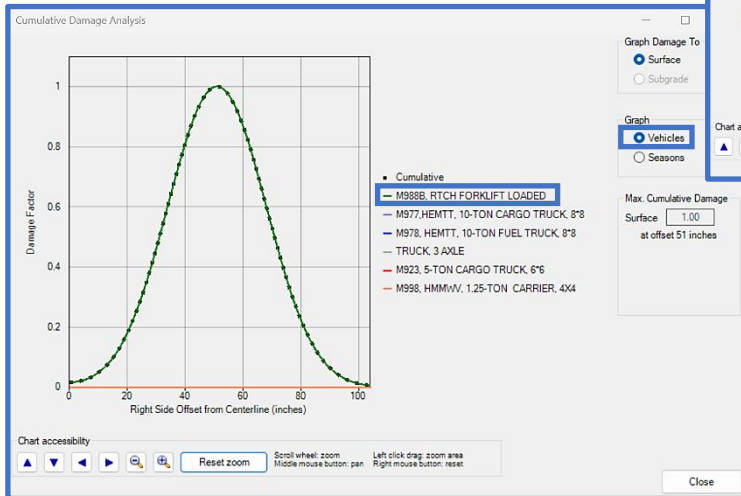
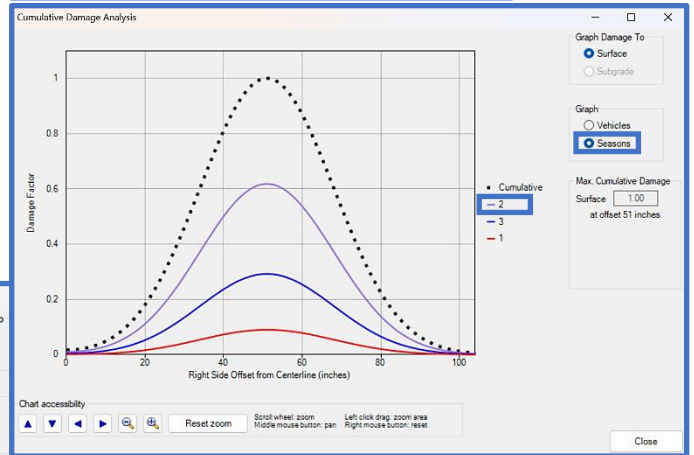
Joint Spacing: ft.

Dowels

Spacing: in.

Length: in.

Diameter: in.



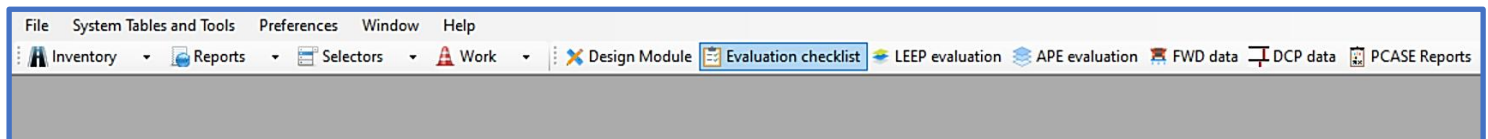
12 Evaluation Checklist

Evaluation checklist displays sections in the selected Evaluation and the APE and LEEP status. Sections can be added, edited and deleted. The checklist also provides access to the Evaluation Manager and Inventory form, allows you to import or export evaluation data, run reports, and works as a selector when an evaluation form is set to Respond to selections.

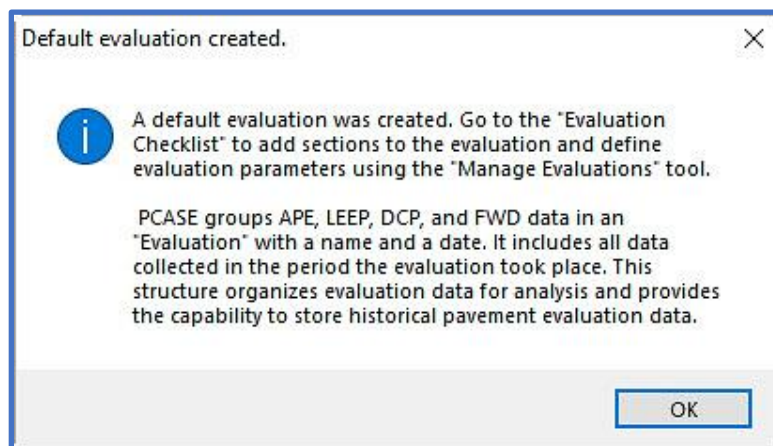
Prior to beginning a new evaluation, ensure that you have opened or created a database to store the evaluation within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference [Chapter 2 File Menu](#).

12.1 Getting Started

Select Evaluation Checklist on the PCASE 7 tool bar to open the checklist.



If you have not imported or created an evaluation in the current database, the message below pops up indicating a default evaluation was created. Click **OK** to continue and open the Evaluation checklist.



If you created a new database the checklist will be empty. When the Evaluation checklist opens you can select **Evaluation Manager** to create a new evaluation or **Show inventory form** to define an inventory. If previous evaluations were created; the **Evaluation** drop-list is used to navigate to the appropriate evaluation. Additional newer features on the Evaluation Checklist are the import/export evaluation functionality and the ability to run a batch analysis.

12.2 Show inventory form

Inventory is normally defined prior to using the Evaluation Checklist. However, **Show inventory form** launches the form and **List Selector** so that you can define an inventory directly from the Evaluation Checklist. Reference [Chapter 7.1 Define Inventory](#) for guidance prior to creating an inventory.

12.3 Evaluation Manager

Evaluation Manager serves to establish global analysis parameters and can be accessed from the Evaluation Checklist, LEEP, APE, FWD, or DCP modules. If you have historical evaluation data from an earlier version of PCASE to import, go to [Chapter 2.2 New/Import](#) for instructions on how to import a PCASE 2.09 database. Once the import is successful, evaluations from the imported database will be available within the **Evaluations** drop-list on the Evaluation checklist and Evaluation Manager forms. The Evaluation Manager form is displayed below. You will go through various sub-sections of the form to set up the analysis parameters. The sub-sections are **Evaluation**, **Climate**, **Temperature settings**, **Default evaluation settings**, **Default APE settings**, and **Default LEEP settings**. **Mark as historical** locks the Evaluation and makes all the data read-only, this can be reversed by clicking on the button again to **Allow edits of Historical Data**. *Note: Before upgrading to version 7.0.8, mark evaluations created using version 7.0.7 as historical. Due to slight variances in climate data between both versions, PCASE will detect those differences and in some cases require recalculation; clearing preexisting results.*

12.3.1 Evaluation

1. Choose an **Evaluation** from the drop-list, or;
2. Click **New** to create an Evaluation then input an **Evaluation name**. The **Default evaluation date** will populate with the current date; select the calendar icon or type in the field to modify the date. Recommend using the first projected day for the start of the evaluation. Select the appropriate radio button to enable/activate sections to include in the Evaluation:
 - **Include All Sections (PCASE 2.09 default behavior)**: All Sections will be included in the Evaluation. You will still have the ability to choose from these Sections later while using the various Evaluation tools.
 - **Select sections to include, using the Query Tool, after create**: This option opens the Query Tool Wizard where you can define Section criteria. The Tree Selector will highlight Sections from the list by default. Choose a **Field** in the **Select Rows** tab, then choose a **Comparison**. Click **Finish** (button will enable after selections have been made) to create the subset.
 - **Add Sections Later**: This option will not bring Section data into the Evaluation. Ad-hoc Sections can be created directly from the APE, LEEP, or DCP forms.
3. The default **Service** from the evaluation default preference setting populates, to change the **Service** use the drop-list to select a different option that is appropriate for the Evaluation.

4. The next two fields are optional. Add a **Description** and **Comments**, if so desired.
5. The **Copy** function allows you to choose which data to include, then creates a copy of the currently selected **Evaluation** with the specified properties.

The screenshot shows the 'Evaluation Manager' window. It has a table with one row containing 'My first evaluation (4/19/2023)'. To the right of the table are buttons: 'New', 'Copy', 'Rename', and 'Delete'. Below the table are fields for 'Date' (Wednesday, April 19, 2023) and 'Service' (Air Force). At the bottom are 'Description' and 'Comments' text boxes. Numbered callouts point to: 1. The evaluation name dropdown, 2. The 'New' button, 3. The 'Service' dropdown, 4. The 'Description' text box, and 5. The 'Copy' button.

The screenshot shows the 'Copy a previous evaluation' dialog box. It has fields for 'New evaluation name' and 'New evaluation date' (Wednesday, April 19, 2023). Below these are checkboxes for 'Check items you wish to copy': 'Climate Data', 'Traffic Patterns', and 'Evaluation Sections, Settings and Layer Models'. There are three radio buttons: 'Copy both APE and LEEP evaluations' (selected), 'Copy only APE', and 'Copy only LEEP'. At the bottom is a checkbox 'Update evaluations settings to PCASE 7 defaults'. Callouts provide additional information:

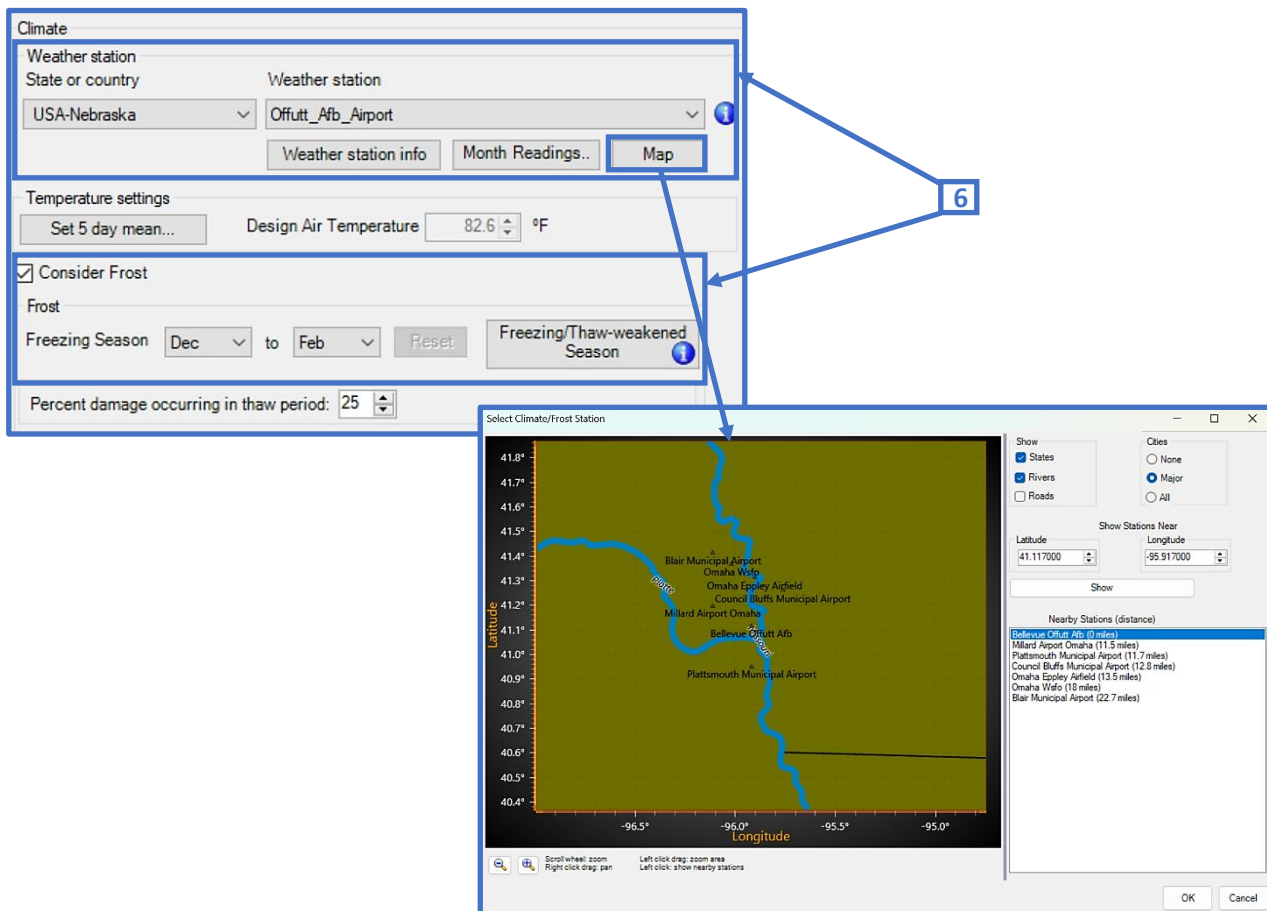
- Left callout: 'If you choose not to copy traffic patterns from the original evaluation, then the traffic pattern set in evaluation defaults will be applied to the copied evaluation.' (points to 'Traffic Patterns' checkbox)
- Right callout: 'If the Evaluation to be copied is set to historical mode (2.09 imported) and APE and/or LEEP are selected, then the Sections in the copied evaluation will be set to the calculation option from your default preference.' (points to the radio buttons)
- Bottom callout: 'For evaluations created using PCASE 7, the option to apply the calculation option set in your default preferences to the copied evaluation will be available' (points to the 'Update evaluations settings to PCASE 7 defaults' checkbox)

12.3.2 Climate

6. The climate database was updated in version 7.0.8. Evaluations that were created using previous versions of PCASE 7 will now show a "Legacy Weather Station". You can use the old data from the previous climate database or select a weather station from the new climate database. Choose the **State or country** and **Weather station** you would like to pull climate data from for the Evaluation. Select **Map** to search for nearby weather stations, choose from the **Nearby Stations** box, then **OK**. Once a **Weather Station** has been selected, you can roll over the **i** icon or click on the **Weather station info** button to view the frost details. Select **Month Readings** to display the **Climate Data Summary**: Mean Daily Maximums, Mean, and Mean Daily Minimums for each month (the data populates automatically and should only be

edited if you have more detailed information on the location). The **Design Air Temperature** for the selected **Weather station** is displayed; if no **Weather station** has been selected the field is enabled so that you can input a temperature. **Set 5 day mean** launches a form where you can input daily temperature values to determine the five-day mean (highlighted in blue). Select the **Consider Frost** checkbox, if applicable. The **Freezing Season** drop-lists will enable and display the calculated freezing season from the **Climate Data Summary**.

- The **Mean Annual Temperature**, **Mean Annual Freezing Degree Days**, and **Mean Length of Freezing Season** are based on an average of the 3 coldest years.
- The **Mean Annual Freezing Degree Days** are based on the average temperature of a day; a day is defined from midnight to midnight. The Freezing Degree Days is calculated by summing the number of degrees below 32 F per day over the year period (the year period is the average of the 3 coldest years) $FDD = \text{SUM}(32 - T_{\text{avg}})$.
- The **Mean Length of Freezing Season** is the number of days within a year-period, where the average temperature of a day is at or below 32 degree F (again based on the average of the 3 coldest years). It is simply the summation of days where the temperature is at or below 32 degree F. The Freezing Season length displayed is based on the first day and last day when the average daily temperature is at or below 32 degrees F. If you choose to edit the default **Freezing Season** months, the **Reset** button will enable and allow you to reset changed values back to the original defaults.



7. **Set 5 day mean** launches a form where you can input daily temperature values to determine the five-day mean (highlighted in blue).
8. The **Percent Damage occurring in thaw period** setting propagates from evaluation defaults and can be overridden on Evaluation Manager.

Temperature settings

Set 5 day mean...

Design Air Temperature 81.0 °F

☒ Consider Frost

Frost

Freezing Season Nov to Mar Reset Freezing/Thaw-weakened Season

Percent damage occurring in thaw period: 25

Default Preferences

Overview GIS Settings Inventory Inspection Verification Tools Menus Graph Defaults PCASE De

Features Design Defaults Evaluation Defaults

Shared APE/LEEP Defaults

☐ Open evaluation checklist with LEEP or APE

Default Service: Air Force Default Controlling Traffic Option: Calculate Controlling Vehicle

Default Traffic Pattern: C17 AT 50,000 PASSES

☐ Consider Frost ☐ Calculate Overlays

Default Cb: 0.8

Default Cr: 0.75

Percent damage occurring in thaw period: 25

Daily highs and lows

Evaluation start date Wednesday, September 28, 2022

Test date Tuesday, September 27, 2022

	Sunday 'F 9/18/2022	Monday 'F 9/19/2022	Tuesday 'F 9/20/2022	Wednesday 'F 9/21/2022	Thursday 'F 9/22/2022	Friday 'F 9/23/2022	Saturday 'F 9/24/2022
Daily Highs	?	?	?	?	66.0	64.0	66.0
Daily Lows	?	?	?	?	43.0	45.0	45.0
Daily Average	?	?	?	?	54.5	54.5	55.5
Five day mean	?	?	?	?	?	?	?

	Sunday 'F 9/25/2022	Monday 'F 9/26/2022	Tuesday 'F 9/27/2022	Wednesday 'F 9/28/2022	Thursday 'F 9/29/2022	Friday 'F 9/30/2022	Saturday 'F 10/1/2022
Daily Highs	57.0	59.0	55.0	55.0	?	?	?
Daily Lows	48.0	41.0	45.0	45.0	?	?	?
Daily Average	52.5	50.0	50.0	50.0	?	?	?
Five day mean	?	?	53.4	52.5	51.6	?	?

	Sunday 'F 10/2/2022	Monday 'F 10/3/2022	Tuesday 'F 10/4/2022	Wednesday 'F 10/5/2022	Thursday 'F 10/6/2022	Friday 'F 10/7/2022	Saturday 'F 10/8/2022
Daily Highs	?	?	?	?	?	?	?
Daily Lows	?	?	?	?	?	?	?
Daily Average	?	?	?	?	?	?	?
Five day mean	?	?	?	?	?	?	?

Legend

Evaluation start date

Enter a mean value and range to generate temperatures

Close

Generate 5 day temperatures before 9/27/2022

Mean Temperature 70.0 °F

Daily Range 10.0 °F

OK Cancel

As a short-cut, a single mean temperature and daily range can be added using this method.

Input temperatures for the five days that precede the test date to compute the Five day mean (highlighted in blue) or select Enter a mean value and range to generate temperatures. These inputs will only apply to newly created evaluations.

12.3.3 Default evaluation settings

9. The **Report PCR Using Vehicle** drop-list contains each vehicle in the selected traffic pattern. This option correlates with the individual vehicle PCR calculation options. The selected vehicle will be used for the Reportable PCR and published in evaluation reports.
10. Select **Calculate overlays** to enable calculation of overlay thicknesses (applicable for both flexible and rigid pavements) when executing APE or LEEP evaluation analyses.

11. If a database has been imported, the existing traffic patterns for the Evaluation will be available in the **Default traffic pattern** drop-list. To define or select a **Default traffic pattern**, select the  icon. *Note: Newly created Evaluations will inherit the Default traffic pattern that is set in PCASE Defaults > Evaluation Defaults.*
12. To define a new traffic pattern with specific vehicles, select **Create**. Enter a unique **Pattern Name**, select a **Pavement Use**, then click **OK**.
13. Choose the appropriate **Traffic Analysis Type** (**Individual** to analyze each vehicle in the pattern, **Mixed** to determine the **Controlling Vehicle**, or **Hybrid** to produce an additional hybrid model result based on a specific subset of vehicles). If you selected **Mixed**; drop-list fields for **Subgrade Category**, **Traffic Area**, and **Pavement Type** will populate for you to define. If **Hybrid** is selected a **Representative Vehicles** button populates within the Evaluation Manager, which allows you to modify selection of the default representative vehicles used for the hybrid analysis. The vehicles in the **Current Representative Vehicles** box will be used in the hybrid analysis, use the arrows to move selected vehicles.
14. Click **Add** to select vehicles for a newly created pattern from the **Choose Vehicles** form. An **Air**, **Ground**, or **Both** vehicle filter is available to help you narrow selections. Click on a box to the left of a vehicle name, or on the vehicle name to select it. Click **OK** to assign the selected vehicles to the pattern.
15. Select **Add from Catalog** to open the vehicle catalog. Filter vehicles based on set categories or by typing a vehicle name in the search field. A visual representation of each vehicle's gear configuration is displayed. Selected vehicles are shown on the right-side of the form. Once all vehicles have been selected for the traffic pattern, click **Add Selected**.
16. The default values for **Load** and **Passes** can be edited within the grid cells, unless cells are colored gray (which signifies the pattern is set to read-only).
17. If **Traffic Analysis Type Mixed** is selected; the **Equivalent Passes** for each vehicle and the **Controlling Vehicle** will be displayed in the grids. The **Equivalent Passes** are sensitive to the defined **Traffic Area**, **Subgrade Category**, and **Pavement Type**. If you'd like to set a different vehicle as controlling, uncheck **Auto Detect Controlling** and choose the vehicle from the drop-list to set as controlling.
18. Choose **Standard** to select from Tri-Service, pre-defined traffic patterns. Click on a box to the left of a standard pattern name or on the name to select it. Choose to save the pattern as **Traffic Read-only** (default) or **Make a Read/Write Copy** (editable). Click **OK** to assign the selected pattern.
19. Choose **Import** to select an existing traffic pattern or a .ptrp file to import into the selected evaluation.
20. Select **Export** to save a file of the selected traffic pattern. Choose a location using file explorer to save the .ptrp file. The file can be shared or imported into another database/evaluation.
21. The **Pavement Use** assigned to the pattern is displayed.
22. Select **ACN/ACR Curves** to view the Aircraft Classification Number (ACN) and Aircraft Classification Rating (ACR) for vehicles.
23. Click **Close** to exit the Traffic form and return to the Evaluation Manager.

Default evaluation settings

11 Default traffic pattern 14 GROUPS-Copy

9 Report PCR Using Vehicle
*GROUP10 (585,000 lb, 50,000)

10 ☐ Calculate overlays

Import Patterns

Import Options:
☒ Import from existing database/project
☐ Import from a Traffic Pattern Export (.PTRP) file

Source Database: Evaluation Traffic Template (Paver7 MS Access)

Source Project: Traffic Template

☒ Composite Traffic
☐ AFSSOC Traffic
☐ PACAF Traffic
☐ USAFE Traffic

Ok Cancel

Note: Traffic area A, B, C, and D only apply to airfields. Roads will display one column each for load and passes

Traffic

Patterns in Selected Project My Traffic Pattern

12 Create Delete Rename Copy 19 Import 20 Export Standard 18

13 Traffic Analysis Type Mixed Traffic Area Traffic Area A ?
 Subgrade Category Cat A Pavement Type Flexible
 Pavement Use Airfield

14 Vehicles 15 Add Add from catalog Delete

Traffic	Load (lb)		Passes		Equivalent Passes	
	Areas A, B	Areas C, D	Areas A, B, C	AreaD		
B-52H STRATOFORTRESS	488,000	366,000	1,000		10	1,000
C-17A GLOBEMASTER III	585,000	438,750	1,000		10	13
C-130J HERCULES	175,000	131,250	1,000		10	1

16

Controlling Vehicle

B-52H STRATOFORTRESS	488,000	366,000	1,000	10	1,014
----------------------	---------	---------	-------	----	-------

17

ACN/ACR Curves 22

☒ Auto Detect Controlling

Close 23

Vehicle catalog

Vehicle Filter
☒ Aircraft
☐ Ground
☒ Military
☐ Civilian
☐ User defined only

Search in name, category, standard load

Available vehicles

Attack/Observation/Battle Management
 AC-130H SPECTRE
 AC-130U SPOOKY

Standard load 175,000 lb

Selected vehicles
 C-130J HERCULES

Standard load 175,000 lb

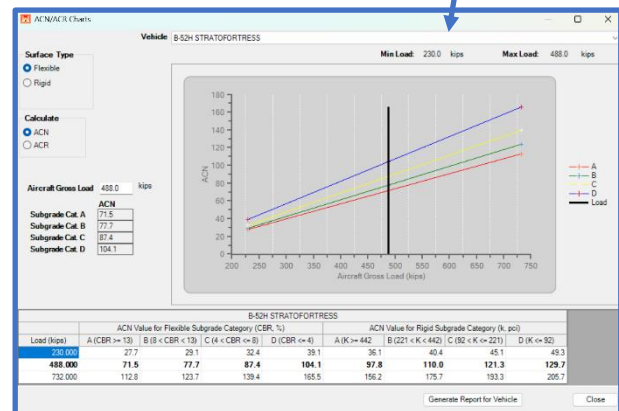
Carqo/Transport/Special Duty
 C-130E HERCULES
 C-130H HERCULES
 C-130J-30 HERCULES

Standard load 175,000 lb

Standard load 175,000 lb

Standard load 175,000 lb

Left click vehicles to add or remove them from the selection. Add Selected Cancel



12.3.4 Default APE settings

24. Set the default **Rigid criteria** for a APE Evaluation of a rigid pavement. The APE **Rigid criteria** options are: **First Crack**, **Shattered Slab**, or **Complete Failure**. The default criteria for each Service will populate when the **Service** is changed. Select the checkbox for **Use Alpha Criteria** to use PCASE 2.09.02 analysis criteria for flexible pavement analysis.

Default APE settings
Analysis

24 Rigid criteria Shattered Slab ☐ Use Alpha Criteria

12.3.5 Default LEEP settings

25. Select the default **Rigid Failure SCI** for a LEEP Evaluation of a rigid pavement. The LEEP **Rigid Failure SCI** options are: 0, 50, and 80. The **Rigid Failure SCI** value will update with the appropriate default value when the **Service** is changed within the form.
26. Set default control parameters form is applicable to the **LEEP Modulus Backcalculation** procedure.
27. The **Thaw Modulus Reduction Method** defaults to **Use Modulus Reduction Factors** and cannot be changed for new evaluations. If an imported evaluation was set to “Use FASSI or FAIR Values” the existing layer models will retain that setting. However, if those layer models are recalculated, the modulus reduction factors setting will be used.

Default LEEP settings
Analysis

25 Rigid Failure SCI 0

Backcalculation

26 Set default control parameters..

27 Thaw Modulus Reduction Method

☒ Use Modulus Reduction Factors ☐ Use FASSI or FAIR Values

12.4 Evaluation checklist

To navigate the Evaluation checklist:

28. Ensure the correct **Evaluation** is selected in the drop-list field. **Section** data displays in the grid if PCASE data was imported (reference [Chapter 2 File Menu](#)) or an inventory has been pre-defined (reference [Chapter 7.1 Define Inventory](#)) in the current database.
29. The **Export Evaluation Data** and **Import Evaluation Data** functions provide a simplified method for sharing updated Evaluation data when working with multiple teams. Selecting either option launches File Explorer so you can choose the evaluation file to import or export into the current database. Guidance for using the evaluation import/export feature is as follows.

PCASE Data and E70s:

1. To build an e70 after PCASE data has been created or edited with PCASE, you ***must*** export the e70 from PCASE.
2. Once this is done, PCASE data will “round trip” through PAVER™. That is, you can import the e70 created via the PCASE file using PAVER™, edit the PAVER™ data, and export it in PAVER™ and the new e70 will have the original PCASE data.
3. But once a database has been opened in PCASE, you must use PCASE to export it in order for **updated** PCASE data to go along. The reason for this is that PCASE data has to be “packed” into a special table for PAVER™ to include it e70 file. This packed data will still be there if you extract the e70 with PAVER™, and it will still be there if you create a new e70 with PAVER™. However, once you open a database with PCASE (or import it using PCASE) the data is “unpacked” out of the special table and only PCASE knows how to pack it back up again.

PCASE Evaluation Data Export / Import:

The PCASE Evaluation Data Export / Import on the Checklist form were created to aggregate data from multiple team members into the master database without the need to create/manage e70s.

PCASE is used to create the master database e70 as outlined in the previous explanation.

The master database can be maintained by the person doing the PAVER™ inspection or could be maintained by one of the teams doing the PCASE evaluation work.

Case 1: Master database maintained by team member doing PAVER™ work:

- Provide a copy of the master database e70 to each team involved in the evaluation.
- Teams perform structural evaluation field work; HWD, DCP, and APE or LEEP modeling etc.
- Export the data from the field work to a .pex file using **Export Evaluation Data** tool on the Evaluation Checklist form.
- Import each team’s .pex files into the master database to aggregate the PCASE data.

Case 2: Master database maintained by team member doing PCASE work:

- Provide a copy of the master database e70 to each team involved in the evaluation.
- Teams performing PCI inspection use the Export PCI Inspection data tools on the inspection dropdown in PAVER™.
- Person maintaining the master database uses the Import PCI Inspection data tools on the inspection dropdown in PAVER™.
- Teams doing structural evaluation field work export the data from the field work to a .pex file using **Export Evaluation Data** tool on the Evaluation Checklist form.
- Import each team’s .pex files into the master database to aggregate the PCASE data.

Note: that any PCI family modeling or work planning will still need to be done in PAVERTM but all of the PCI inspection and structural evaluation data will be in the database

Master database inventory Changes:

LEEP and APE make copies of the inventory data when the evaluation is created. If there are inventory changes in the master database, the master owner, after importing the PEX, has to **Refresh section properties** in the Evaluation Checklist. This will pull the PAVERTM section changes into the evaluation copy. The layer models won't be affected except that their "needs to be recalculated" flag may be set and the user must recalculate results.

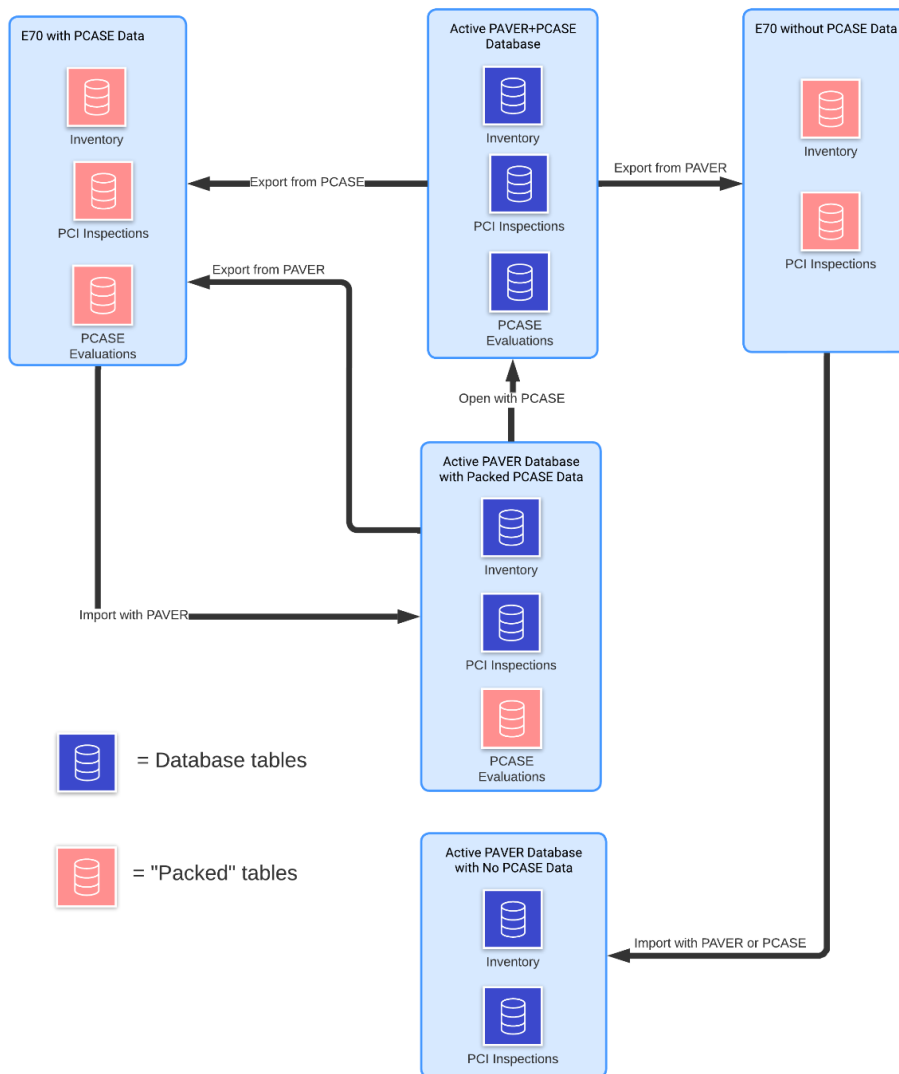


Figure 1: E70 Import/Export with PAVER and PCASE data

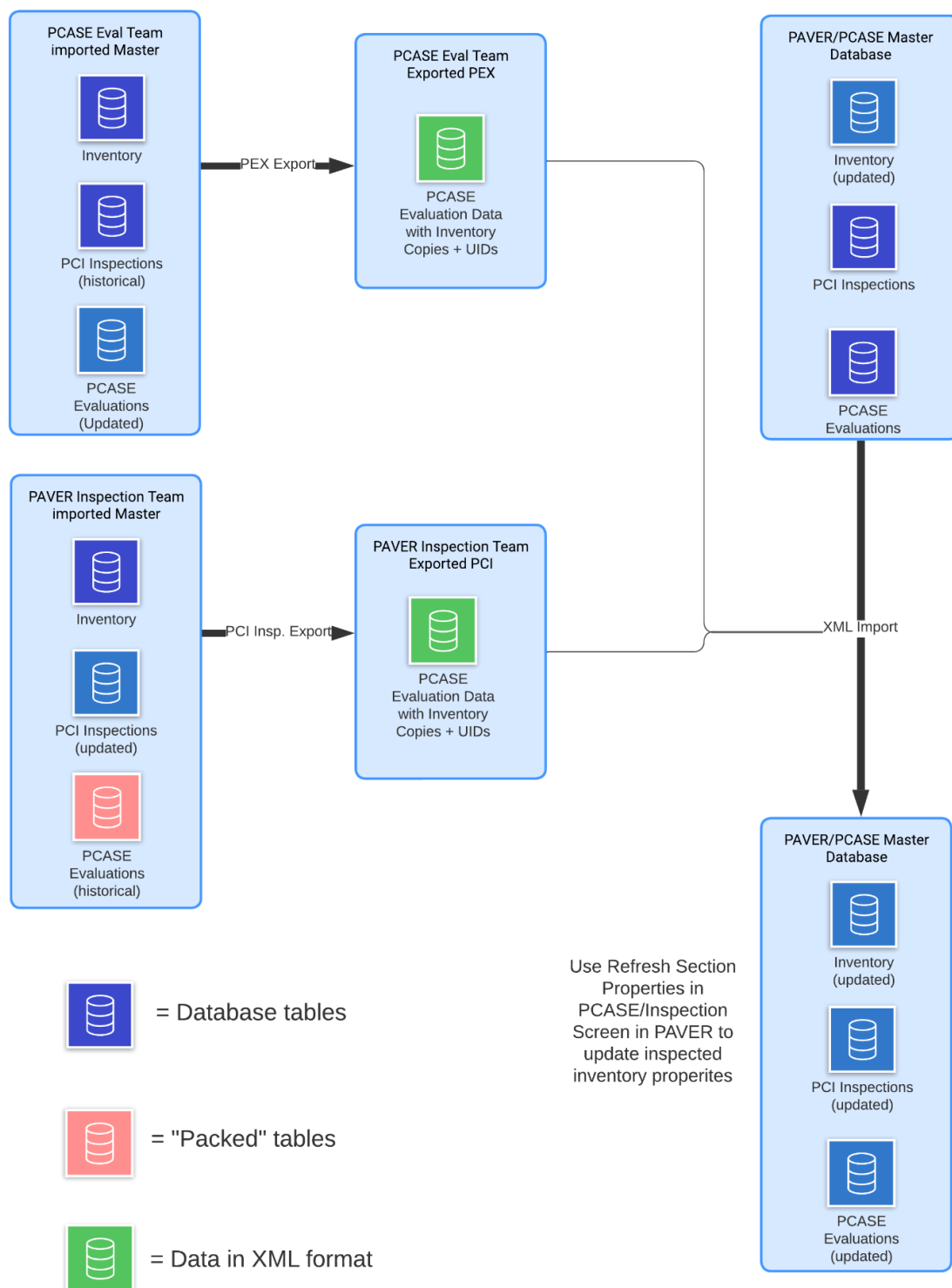


Figure 2: PAVER™/PCASE inspection team export/import to master

30. Select **Edit section properties** to:
 - a. Input the **PCI** and **% Load-related Distress** values for calculating the condition factors (**C_b**, **C_r**) for rigid overlays
 - b. Change the **Traffic area** and/or **Load frequency** values.
 - c. Select **Evidence of Frost Damage** if applicable.
31. Select **Refresh section properties** to update the section properties from the pavement inventory.
32. Select **Show inventory form** to open the inventory form.
33. To manage which Sections are included in the selected Evaluation, select **Add all sections** or **Add subset of sections**. **Add subset of sections** opens a query tool for selecting the Sections to add; this is recommended if there are multiple Evaluations within a database.
34. Select **Add ad-hoc section** to create an “ad-hoc” Section (a Section created on the fly that is not included in the defined inventory).
35. To delete a Section, highlight the Section and click **Delete section**.
36. Select **Evaluation** to run a batch analysis. All necessary properties must be defined for each selected section, in order for the button to become enabled. Status messages are provided to notify you of each sections current state. If there is missing information, open the APE or LEEP form to define the missing data. Select the **Assigned** option to run batch calculation for all selected sections using the **Calculation Options** setting on the APE or LEEP form. The **Additional** calculation option allows you to select another traffic pattern that is applied to each selected section for an additional traffic analysis. An additional **Calculation option** can also be applied to the batch analysis. An explanation of each Calculation option type is provided in the APE evaluation and LEEP evaluation chapters.
37. Select **Backcalculation** to run a batch backcalculation analysis. After backcalculation results have populated, select the **Evaluate** button if you wish to run a batch analysis.
38. Select **Reports** to access the predefined Evaluation reports window. See [Chapter 17 Reports](#) for more information. *Note: PCASE reports use Excel templates without any classification markings based on the assumption that all data is unclassified and publicly releasable. If the information in the individual database is Controlled Unclassified Information (CUI), properly mark any reports generated by PCASE at the appropriate classification level. Add a header and footer with the appropriate classification markings.*
39. Click on a column header and drag it to the **Drag column here to group by** box to sort grid data by the selected header.
40. Click **Close** to exit the Evaluation checklist.

28

24 Silver Flag Structural (5/7/2024)

39

Sections

Drag column here to group by

29

Export Evaluation Data

Import Evaluation Data

Once an evaluation has results, the status will update.

Section Name	Ad hoc	Surface type	Use	APE	APE status	LEEP	LEEP Status
SilverFlag::RW0927::R01A	☐	PCC	RUNWAY	2	has results	1	no results
SilverFlag::RW0927::R02C	☐	AC	RUNWAY	2	has results	1	no results
SilverFlag::RW0927::R03A	☐	PCC	RUNWAY	3	has results	1	no results
SilverFlag::RW1331::R04A	☐	GR	RUNWAY	2	has results	1	N/A
SilverFlag::TWIA::T01A	☐	AC	TAXIWAY	2	has results	1	no results
SilverFlag::TWB::T02C	☐	APC	TAXIWAY	2	has results	2	no results
SilverFlag::TWC::T03A	☐	GR	TAXIWAY	3	has results	1	N/A
SilverFlag::AP Main::A01B	☐	PCC	APRON	2	has results	1	no results

30

Edit section properties

31

Refresh section properties

32

Show inventory form

38

Reports

33

Add all sections

34

Add subset of sections

35

Add ad-hoc section

35

Delete section

36

Evaluation

37

Backcalculation

40

Close

Calculate Evaluation Results

Evaluation

26 Silver Flag Structural

What to calculate

☐ Assigned
 ☒ Additional

☒ Traffic Pattern

Contingency Traffic

☒ Calculation Option

Calculate PCR

Section	Status	Calculate
APE (8 items)		
SilverFlag::AP Main::A01B	No results	☒
SilverFlag::RW0927::R01A	No results	☒
SilverFlag::RW0927::R02C	No results	☒
SilverFlag::RW0927::R03A	No results	☒
SilverFlag::RW1331::R04A	No representative layer model	☐
SilverFlag::TWIA::T01A	No results	☒
SilverFlag::TWB::T02C	No results	☒
SilverFlag::TWC::T03A	No representative layer model	☐

Select All

Select Default

Select None

Calculate Selected

Close

Unsurfaced and Mat structures do not qualify for PCR calculation, so the batch calculation logic excludes those sections

Section status indicates there are no results when sections are ready to be calculated

Results are provided for the additional traffic pattern and selected calculation type

Layer Model

New

Copy

Rename

Delete

Order by Section ID

1

Name

SilverFlag::AP Main::A01B (2 items)

01

01 - Contingency Traffic-PCR

01

01 - Contingency Traffic-PCR

SilverFlag::RW0927::R01A (2 items)

01

01 - Contingency Traffic-PCR

SilverFlag::RW0927::R02C (2 items)

01

01 - Contingency Traffic-PCR

SilverFlag::RW0927::R03A (5 items)

Traffic

Section

Airfield Traffic Pattern

Contingency Traffic

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	Flex Strength (psi)	Modulus (psi)	Poisson's Ratio	Bond
PCC Partially Bonded Overlay	Portland Cement	8.00			700	5,000,000	0.15 Partially Bonded
Portland Cement Concrete	Portland Cement	10.00			700	5,000,000	0.15 Partially Bonded
Natural Subgrade	Cohesionless Cut	222.00	15.1			19,725	0.40 Fully Bonded

Add

Change

Delete

Show Layer Details

Results

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
C-130J HERCULES	175,000	100	148,178	21	373	306		0.7	Green
C-130J HERCULES	155,000	100	148,178	21	323	306		0.6	Green
C-130J HERCULES	135,000	100	148,178	21	275	306		0.5	Green
C-17A GLOBEMASTER III	585,000	50,000	495,339	10,598	547	434		1.0	Green
C-17A GLOBEMASTER III	500,000	100	495,339	21	440	434		0.8	Green
C-17A GLOBEMASTER III	450,000	100	495,339	21	383	434		0.7	Green
C-5A/B GALAXY	840,000	100	711,256	21	414	314		0.7	Green
E-3 SENTRY AWAC	325,000	100	276,188	21	494	387		0.9	Green
F-15D EAGLE	68,000	100	57,578	21	296	251		0.6	Green
HC-10A REFUELER	590,000	100	499,572	21	667	523	523 R/B W/O	1.3	Amber
HC-135R/T STRATOTANK...	322,500	100	273,071	21	439	342		0.8	Green
MV-22 OSPREY	60,500	100	51,227	21	127	103		0.2	Green

13 LEEP Evaluation

LEEP evaluation is capable of analyzing pavements using the layered elastic method producing resultant allowable loads, passes, Pavement Classification Numbers (PCN), Pavement Classification Rating (PCR), and overlay requirements.

Prior to beginning a new evaluation, ensure that you have opened or created a database to store the evaluation within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference [Chapter 2 File Menu](#).

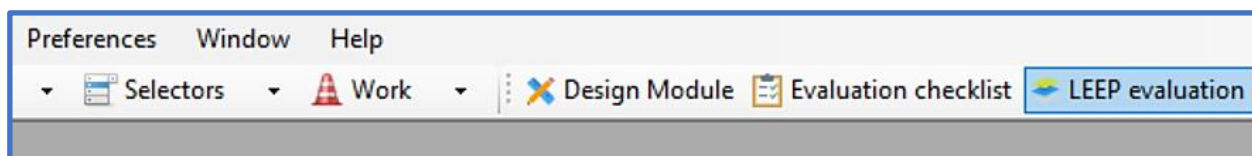
Prior to using LEEP evaluation form, ensure you have defined your inventory (unless you will be creating sections Ad Hoc); reference [Chapter 7 Inventory](#).

The asset inventory should be initialized prior to using the LEEP evaluation form; reference [Chapter 12 Evaluation checklist](#).

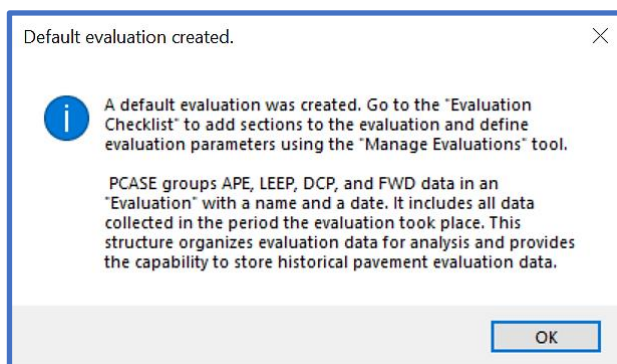
The modulus Backcalculation function within LEEP Evaluation requires uploading FWD/HWD files, data processing, inventory sectioning and subsequent station assignment. For instructions on how to import FWD/HWD data and assign to sections and stations; reference [Chapter 15 FWD data](#).

13.1 Getting Started

To get started, select LEEP evaluation on the PCASE 7 tool bar to open the evaluation tool.



If you have not imported or created an evaluation in the current database, the message below pops up indicating a default evaluation was created. Click **OK** to continue and open the LEEP evaluation form.



13.2 LEEP Evaluation Form

The LEEP evaluation form (displayed below) serves to perform complete evaluation of airfield and road pavements employing layered elastic procedures. To run a LEEP evaluation, you will go through various sub-sections of the form to modify the default analysis conditions, if desired. The sub-sections are Evaluation Manager, Layer Model, Traffic and Section tabs, Settings, and Layers. The analysis output results are displayed within the Results sections. Respond to selections allows you to use the Evaluation Checklist or any Selectors to change the focus of a section in an evaluation. The Reports button displays when analysis results are present. The panels in the LEEP form are adjustable and you can save a form configuration using the Save Layout function. Select Close to exit LEEP evaluation.

The screenshot displays the LEEP Evaluation Form for Location STALLION-RW1432-R01A. The interface includes several panels:

- Evaluation Manager:** Shows a list of evaluation items with columns for Name, Order by Section ID, and a checkbox for Default model. The selected item is STALLION-RW1432-R01A (1 items).
- Settings:** Contains checkboxes for Use Backcalculation and Calculate Overlays. It also includes a section for FWD data with a message: "33 of 88 basins will be evaluated. Station 2, drop 2 is representative." and a section for Temperature settings with a Set 5 day mean of 73.4 °F. The Load Frequency is set to 20, and the Avg AC modulus based on temperature is 157561.
- Layers:** A table showing the layer structure for the evaluation.
- Results:** A table displaying the evaluation results, including Evaluation Load (lb), Evaluation Passes, AGL (lb), Allowable Passes, ACN, PCN, PCN String, ACN/PCN, ACN/PCN Rating, and AC Overlay (in.).

The Results table shows the following data:

Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACN	PCN	PCN String	ACN/PCN	ACN/PCN Rating	AC Overlay (in.)
130,000	14,401	156,960	119,918	20	25	25/F/A/W/T	0.8	Green	0.0

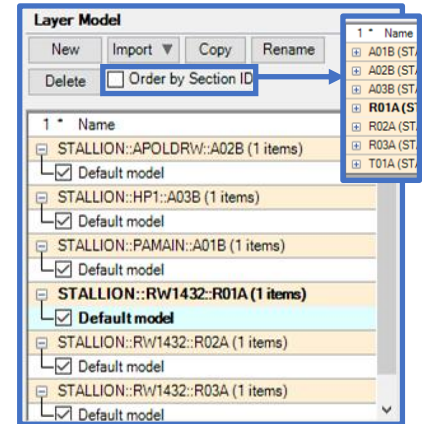
13.2.1 Evaluation Manager

Evaluation Manager serves to establish global analysis parameters. To navigate Evaluation Manager; reference Chapter 12 Evaluation Checklist, [Section 12.3 Evaluation Manager](#).

13.2.2 Layer Model

The **Layer Model** grid lists default pavement structures that may be modified in the **Layers** grid, to produce analysis results for a Section of a LEEP evaluation in the **Results** grid.

Multiple layer models (each with distinct, user-specified analysis conditions and results) can exist for a given section of an Evaluation. To create a new **Layer Model**, select **New**. To import a model from another evaluation, a design, DCP, or APE (from the same evaluation) select **Import**. The model must be within the currently open database. To copy an existing model and all the associated analysis conditions and results, select a model then select **Copy**. Select **Rename** to edit the default **Layer Model** name. To delete a model replicate, select the model then **Delete**.



13.2.3 Traffic tab

1. Traffic patterns defined within **Evaluation Manager** are available for selection in all evaluations. An existing traffic pattern can be selected from the drop-list within the **Traffic** tab, or a new traffic pattern can be created by selecting the  icon, then **Create** (user-defined traffic) or select a **Standard** (pre-defined traffic patterns) pattern.
2. If **Traffic Analysis Type Mixed** is selected, the options for **Controlling Traffic Mode** are: **Use Controlling Vehicle from Pattern**, **Calculate Controlling Vehicle** and **Choose Controlling Vehicle**. **Use Controlling Vehicle from Pattern** will utilize the loading and equivalent passes of the **Controlling Vehicle** defined within the **Traffic** form. This is based on the **Traffic Area**, **Subgrade Category**, and **Pavement Type**. **Calculate Controlling Vehicle** will recalculate the loading and equivalent passes of the **Controlling Vehicle** based on the **Traffic Area** selected in the **Section Properties** sub-section, and the **Subgrade Category** associated with the CBR value of the subgrade within the **Layers** sub-section. **Choose Controlling Vehicle** allows you to select which vehicle in the mix controls. If an **Individual** traffic pattern is selected, the options for **Controlling Traffic Mode** are not displayed.
3. If the **LEEP using LEAGL method for individual vehicles** calculation option is selected, the **Report PCR Using Vehicle** field becomes available so that you can select which vehicle's PCR to use for the Reportable PCR and publish in evaluation reports.

The image displays two screenshots of a software interface's 'Traffic' section. The left screenshot shows the 'Airfield Traffic Pattern' dropdown menu set to 'STALLION' (labeled 1) and the 'Controlling Traffic Mode' dropdown menu set to 'Use Controlling Vehicle from Pattern' (labeled 2). The right screenshot shows the 'Report PCR Using Vehicle' dropdown menu set to 'C-130H Hercules (130,000 lb, 14,400)' (labeled 3).

13.2.4 Section tab

4. The **Inspection/Analysis** tab is comprised of section properties that are applied to an analysis
 - In the **Inspection Data** section; enter the **PCI** and **% Load-related Distress** resulting in the calculated **SCI**, **C_b** and **C_r**. A condition $PCI \leq 40$ will activate a load reduction in the Allowable Gross Load (AGL) and an increase in gross weight. The calculated **SCI** will yield condition factors **C_b** and **C_r** that impact the recommended overlay thicknesses for rigid pavements.
 - In the **Analysis Structure Parameters** section; the **Traffic area** and **Load Frequency** fields can be edited using the drop-lists for flexible structures. For rigid structures, only the **Traffic area** field is displayed.
 - Use the **Traffic area** drop-list to select the appropriate **Traffic Area** (Area A, B, C, or D). If applicable to the analysis (i.e., flexible pavement structure), then select the **Load frequency** associated with the **Analysis-Temp** option. Check the box for **Evidence of Frost Damage** (displayed when a climate station is selected in Evaluation Manager) to enable **Frost Code**, **Moisture Content**, and **Dry Unit Weight** columns in the **Layers** grid. These inputs directly impact the **Results** by including results for frost conditions
5. The **Inventory Properties** tab displays characteristics of the section, as defined in the Network inventory. This tab is set to read-only for inventory sections and editable for ad-hoc sections
 - The characteristics of the **Inventory Properties** tab include:
 - **Name**
 - **Pavement Use**
 - Airfield or Roadway
 - **Branch Use** (Runway, Taxiway, Apron, Roadway, Parking area, etc.)
 - **Pavement Surface**
 - Flexible Surface, Rigid Surface, or Unsurfaced
 - **Surface Type**

- Refresh Properties from PAVER Section becomes enabled once an inventory section's properties have been edited.
- If Consider Frost is checked in Evaluation Manager, the box for Evidence of Frost Damage will be checked by default and enables Frost Code, Moisture Content, and Dry Unit Weight columns in the Layers grid. These inputs directly impact the Results by including results for frost conditions.

4

Inspection/Analysis Inventory Properties

Inspection Data

PCI % Load-related Distress

SCI Cb Cr

Analysis Structure Parameters

Traffic area

Load frequency

5

Inspection/Analysis Inventory Properties

Name

Pavement Use

☒ Airfield ☐ Roadway

Branch Use

Pavement Surface

☒ Flexible Surface ☐ Rigid Surface ☐ Unsurfaced

Surface type

☒ Evidence of Frost Damage

13.2.5 Settings

- Settings comprises of Use Backcalculation, Calculate Overlays and the Backcalculation (displayed when Use Backcalculation is turned on), Analysis, and Overlay (rigid pavements only) tabs.
 - Check the Use Backcalculation box to enable the Backcalculation tab options.
 - Check the Calculate Overlays box to display overlays in Results for pavements that cannot support the assigned traffic.
- Backcalculation tab for a rigid pavement
 - FWD data
 - Select FWD data to open the FWD Data Manager which allows you to Import new files and Assign FWD files to sections.
 - Once the FWD data is added, choose Select Basins to select the basins to be used for Backcalculation. Specific basins can be selected by clicking on a point, or by selecting a range of points by dragging the cursor across the graph. See [Chapter 15 FWD data](#) for more information.

- Backcalculation
 - Select  to open the Backcalculation Parameters form where you can:
 - Set Backcalculation to use RMSE or Percent Error
 - Set Backcalculation thresholds
 - Identify when iterations will terminate
 - Select Run Backcalculation to calculate and display the Detailed Basin Results.
 - The Show basin results... button is enabled after Backcalculation is performed.
8. Analysis tab for a rigid pavement
- Analyze Structure As displays the pavement surface; Rigid or Flexible, extracted from the Section's inventory data.
 - Failure SCI allows you to change the failure criteria. Click on  icon for definitions of the failure criteria.
 - Use the Load transfer options; % Load Transfer or Joint Deflection Ratio to change the Max Edge Stress. The defaults are set for a rigid pavement with good load transfer. Increasing the Max Edge Stress results in lower Allowable Gross Loads (AGL) and allowable passes.
 - If Evidence of Frost Damage is checked; the Depth of Frost tab, Thaw Season tab and the Thaw Modulus Reduction Method option will populate at the bottom of the Analysis tab. Use these options to override values/settings derived from the selected Weather station and Evaluation Manager.
9. Overlay tab for a rigid pavement
- Rigid settings displays the SCI, Cb, and Cr values calculated from the Edit Section Properties form.
 - The default PCC Overlay Flex strength and Modulus values are displayed and are editable. Click on  to view overlay calculation information.
10. Backcalculation tab for a flexible pavement
- FWD data
 - Select FWD data to open the FWD Data Manager which allows you to Import new files and Assign FWD files to sections.
 - Once the FWD data is added, choose Select Basins to select the basins to be used for Backcalculation. Specific basins can be selected by clicking on a point, or by selecting a range of points by dragging the cursor across the graph. See [Chapter 15 FWD data](#) for more information.
 - Temperature settings
 - If Temperature in Backcalculation Options will be used, select Set 5 day mean and enter the daily high and low temperatures for the 5 days that precede the test date; resulting in the 5 day mean. Alternatively, a single Mean Temperature value and Daily Range can be inputted using the Enter a mean value and range to generate temperatures button on the form, which will automatically populate the temperature values for you.
 - Set the appropriate Load Frequency value.

- Avg AC modulus based on temperature displays based on the 5 day mean, Load Frequency, and Asphalt Concrete pavement thickness.
11. Analysis tab for a flexible pavement
- Analyze Structure As displays the pavement surface; Rigid or Flexible, which is derived from the Section's inventory data.
 - Design temperature calculation (flexible pavement only) displays the Air, Pavement, and AC Modulus values (based on the Load frequency set in Edit section properties).
 - If Evidence of Frost Damage is checked; the Depth of Frost tab, Thaw Season tab and the Thaw Modulus Reduction Method option will populate at the bottom of the Analysis tab. Use these options to override values/settings derived from the selected Weather station and Evaluation Manager.

6

Settings

☒ Use Backcalculation

☒ Calculate Overlays

7

Backcalculation Analysis Overlay

FWD data

16 of 28 basins will be evaluated.

Station 6, drop 1 is representative.

Select basins... FWD data..

Backcalculation

Run Backcalculation Show basin results...

8

Backcalculation Analysis Overlay

Analyze Structure As:

☒ Rigid ☐ Flexible

Failure SCI 50 ?

Load transfer

% Load Transfer 25

Joint Deflection Ratio 0.76

Max Edge Stress 75 %

Depth of Frost Thaw Season

☐ Override calculated frost

6.0 in.

Thaw Modulus Reduction Method

☐ Use FASSI or FAIR values

☒ Use modulus reduction factors

Depth of Frost Thaw Season

☐ Override calculated season

Feb to Feb

9

Backcalculation Analysis Overlay

Rigid settings

SCI Cb Cr

91.68 1 0.94

PCC Overlay

Flex strength 650 psi

Modulus 4000000 psi

?

10

Backcalculation Analysis

FWD data

24 of 48 basins will be evaluated.

Station 5, drop 2 is representative.

Select basins... FWD data..

Temperature settings

Set 5 day mean... 65.5 °F

Load Frequency 20 Hz

Avg AC modulus based on temperature 330696 psi

Backcalculation

Run Backcalculation Show basin results...

11

Backcalculation Analysis

Analyze Structure As:

☐ Rigid ☒ Flexible

Design temperature calculation

Air 85.0 °F

Pavement 98.0 °F

Load Freq. 10 Hz (section properties)

AC Modulus 162950 psi

13.2.6 Layers

12. The **Layers** grid populates a default structure for the specified pavement type. The layer model columns include: Layer Type, Material Type, Thickness, Backcalculation Options, Seed Modulus, Min Modulus, Max Modulus, Apply Limit, Modulus Hit Limit?, Backcalculated Modulus, Analysis Options, Modulus (used for analysis), Poisson's Ratio, Bond, failure criteria flags, and Effective k (rigid only).
13. Layer types and their coinciding material types can be added or edited using the **Add** or **Change** buttons beneath the **Layers** grid. To **Add** a layer, select the **Layer category** and the respective material type. The **Change** layer button becomes enabled when the selected layer can be modified. The up and down arrows enable when the selected layer can be moved based on set rules. Select **Calculate** to determine the **Depth to bedrock** after running backcalculation. *Note: The Calculate Depth to Bedrock option is only enabled when FWD data is assigned to the selected section and at least one basin is selected.* Select **Set to 240 in.** to reestablish the subgrade depth based on the layer thicknesses above. Select **Send to APE – Low Volume** (option is displayed for flexible structures when FWD data is associated with the layer model) to send the current model to APE and use the Low Volume method to calculate CBRs. **View Coverages** opens a form that displays vehicle pass-to-coverage ratios. Select the **Comments** button to add notes on the analysis.

Select **Calculation Options** to change the analysis method.

- **LEAGL for PCN** – This option uses layered elastic theory and the traffic is evaluated as individual, mixed, or hybrid based on the parameters configured in the traffic module. This calculation option is used to calculate Pavement Classification Number (PCN) values.
 - **LEAGL for Individual Vehicles** – This option uses layered elastic theory and Cumulative Damage Factor (CDF) methodology to determine allowable aircraft gross loads and allowable passes across the entire traffic mix. This calculation option is used to calculate Pavement Classification Rating (PCR) values.
 - **LEAGL for PCR** – This option uses layered elastic theory and Cumulative Damage Factor (CDF) methodology to determine allowable aircraft gross loads and allowable passes. In this option, CDF is computed for only a single vehicle. This calculation option is used for generating 14-group tables or single-vehicle evaluations (e.g., displaying the PCR for a C-17 at 50,000 passes).
14. The **Stresses/Strains** button launches a window that displays a table of the layer structure's stresses and strains data and allows editing of depths in which to perform analyses.
 15. The **Damage** button is only enabled for **LEEP using LEAGL method for PCR** calculation.
 16. Select **Run Analysis** to initialize the calculation process once all evaluation parameters are established.

12

Layers

	Layer Type	Material Type	Thickness (in.)	Backcalculation Options	Seed Modulus (psi)	Min Modulus (psi)	Max Modulus (psi)	Apply Limit	Modulus Hit Limit?	Backcalculated Modulus (psi)	Analysis Options
▶	Asphalt Concrete	Asphalt Cement	5.00	BackCalc	157,561	50,000	1,000,000	☒	No	270,136	BackCalc
	Base	Unbound Aggregate	8.00	BackCalc	61,000	5,000	225,000	☒	No	75,261	BackCalc
	Natural Subgrade	Cohesive Cut	227.00	BackCalc	20,110	15,000	27,500	☒	No	22,337	BackCalc
	Bedrock	Bedrock						☐			

13

+

 Add

▲ Change

▼

✕ Delete

Depth to bedrock

Calculate

Set to 240 in.

Send to APE - Low Volume

View Coverages

Comments

Calculation Options

Damage

Stresses/Strains

Run Analysis

15

14

16

Add New Layer

1 2 *

Layer category: Overlay (1 items)

Layer type: Asphalt Overlay (1 items)

Layer category: Base (6 items)

Layer type: PCC Base Slab (1 items)

Layer type: AC Stabilized Base (2 items)

Layer type: PCC Stabilized Base (3 items)

Layer category: Drainage (1 items)

Layer type: Drainage (1 items)

Layer category: Separation (2 items)

Layer type: Separation (1 items)

Layer type: Geotextile (1 items)

Layer category: Subbase (9 items)

Layer type: Subbase (1 items)

Layer type: Stabilized Subbase (7 items)

Layer type: Select Fill (1 items)

Layer category: Subbase Drainage (1 items)

Layer type: Subbase Drainage (1 items)

Layer category: Subbase Separation (2 items)

Layer type: Separation (1 items)

Layer type: Geotextile (1 items)

Layer category: Subgrade (14 items)

Layer type: Modified Subgrade (2 items)

Layer type: Compacted Subgrade (4 items)

Layer type: Stabilized Subgrade (8 items)

Ok Cancel

Bedrock Calculation Results

☐ Minimum
 ☐ Maximum
 ☒ Harmonic Mean

in.
 in.
 in.

Apply Cancel

Layered Elastic Detailed Results

Layer Type	Thickness (in.)	Modulus (psi)	Poisson's Ratio	Bond
Asphalt Concrete	5.00	270,136	0.35	Fully Bonded
Base	8.00	75,261	0.35	Fully Bonded
Natural Subgrade	227.00	22,337	0.40	N/A
Bedrock		1,000,000	0.50	N/A

C:\1304 Hercules - 130 kips

Applied Loads

Time Number	X (in.)	Y (in.)	Load (lbs)	Contact Area (in²)
1	95.00	60.00	29,250	400.00
2	95.00	0.00	29,250	400.00

Evaluation Points

X (in.)	Y (in.)
95.00	0.00
95.00	15.00
95.00	30.00

Calculation Depths

Depth (in.)
4.995
13.001

Add Remove

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
X Coord. (in.)	8.6000E+001	8.6000E+001	8.6000E+001	8.6000E+001	8.6000E+001	8.6000E+001
Y Coord. (in.)	3.0000E+001	1.5000E+001	0.0000E+000	3.0000E+001	1.5000E+001	0.0000E+000
Z Coord. (in.)	4.9990E+000	4.9990E+000	4.9990E+000	1.3001E+001	1.3001E+001	1.3001E+001
Stress X (psi)	3.0054E+000	-7.0052E+000	-5.9756E+001	8.2231E+001	8.3070E+001	1.0625E+000
Stress Y (psi)	1.8173E+001	3.4491E+001	5.9814E+001	6.7090E+000	6.4005E+000	1.7308E+000
Stress Z (psi)	1.4870E+000	8.3800E+000	7.0336E+001	4.8655E+000	1.1625E+001	2.6674E+001
Shear Stress XZ (psi)	3.5126E+016	1.0996E+015	1.2791E+007	3.1685E+016	4.6817E+016	1.0295E+007
Shear Stress YZ (psi)	0.0000E+000	-1.7171E+001	-1.0052E+002	0.0000E+000	5.8253E+000	3.3723E+001
Shear Stress XY (psi)	0.0000E+000	2.3709E+015	3.5217E+018	0.0000E+000	1.6746E+016	4.0916E+017
Strain X	1.4247E+005	8.1462E+005	2.3494E+004	1.7045E+004	2.3591E+004	4.6109E+004
Strain Y	6.1452E+005	1.2050E+004	3.3513E+004	1.9850E+004	6.3512E+004	-4.1921E+004
Strain Z	-2.1830E+005	-4.5045E+005	4.1539E+004	8.2956E+005	3.9049E+004	1.1441E+003
Shear Strain XZ	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Shear Strain YZ	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Shear Strain XY	0.0000E+000	1.1849E+020	1.7600E+023	0.0000E+000	1.0497E+020	-2.5645E+021
Displacement X (in.)	-2.6353E+020	-7.3401E+020	-1.8751E+011	-3.1311E+019	-3.1841E+019	-4.4883E+011
Displacement Y (in.)	0.0000E+000	1.2696E+003	9.3445E+005	0.0000E+000	2.4523E+003	-7.3550E+004
Displacement Z (in.)	2.6934E+002	2.6038E+002	3.6227E+002	2.8852E+002	2.8999E+002	3.6530E+002
Princ. Stress 1 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Stress 2 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000
Princ. Stress 3 (psi)	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000	0.0000E+000

17. Select the appropriate Material Type and input the Thickness for each layer.
18. Select an option from Backcalculation Options for each layer (for instructions on running backcalculation see [Chapter 15 FWD Data](#)):
 - a. Asphalt Cement surface layer: BackCalc, Temperature (avg), Temperature (per drop), or Manual.
 - b. Portland Cement Concrete surface layer and all sublayers (except subgrade): BackCalc, En+1, or Manual.
 - c. Subgrade layer: BackCalc or Manual.

Layers			17	18a
Layer Type	Material Type	Thickness (in.)		Backcalculation Options
▶ Asphalt Concrete	Asphalt Cement	5.00		BackCalc
Base	Unbound Aggregate	8.00		BackCalc
Natural Subgrade	Cohesive Cut	227.00		Temperature (avg)
Bedrock	Bedrock			Temperature (per drop)
				Manual

Temperature options are for Asphalt Cement only.

Layers			18b
Layer Type	Material Type	Thickness (in.)	Backcalculation Options
Asphalt Concrete	Asphalt Cement	5.00	BackCalc
▶ Base	Unbound Aggregate	8.00	BackCalc
Natural Subgrade	Cohesive Cut	227.00	BackCalc
Bedrock	Bedrock		En+1
			Manual

Layers			18c
Layer Type	Material Type	Thickness (in.)	Backcalculation Options
Asphalt Concrete	Asphalt Cement	5.00	BackCalc
Base	Unbound Aggregate	8.00	BackCalc
▶ Natural Subgrade	Cohesive Cut	227.00	BackCalc
Bedrock	Bedrock		BackCalc
			Manual

19. Default Seed Modulus, Min Modulus, Max Modulus and Apply Limit settings are provided. To change a value, click on a cell to input a new value.

Layers				19			
Layer Type	Material Type	Thickness (in.)	Backcalculation Options	Seed Modulus (psi)	Min Modulus (psi)	Max Modulus (psi)	Apply Limit
▶ Asphalt Concrete	Asphalt Cement	5.00	BackCalc	200,000	70,000	2,000,000	☒
Base	Unbound Aggregate	8.00	BackCalc	61,000	5,000	150,000	☒
Natural Subgrade	Cohesive Cut	227.00	BackCalc	9,000	1,500	50,000	☒
Bedrock	Bedrock						☐

20. Once the Backcalculation operation is complete, the backcalculated moduli values for each layer will transpose to the Backcalculated Modulus column cells.
21. Select the appropriate options from Analysis Options for each layer:
 - a. Asphalt Cement surface layer: BackCalc, Temperature, or Manual.
 - b. Portland Cement Concrete surface layer and all sublayers (except subgrade): BackCalc, En+1 or Manual.
 - c. Subgrade layer: BackCalc or Manual.

22. The established moduli that will be used for analysis are displayed in the **Modulus** column.
23. Default values for **Poisson's Ratio** and **Bond** are provided. These fields are editable.
24. **Surface** and **Subgrade** failure criteria-flags employed by the LEEP analysis procedure are provided, as well as a **Controlling Criteria** flag.

Layers						20	21	22	23	24		
Layer Type	Material Type	Thickness (in.)	Apply Limit	Modulus Hit Limit?	Backcalculated Modulus (psi)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade ?	Controlling Criteria
▶ Asphalt Concrete	Asphalt Cement	5.00	☒	No	259,702	BackCalc	259,702	0.35	Fully Bond...	☒	☐	☐
Base	Unbound Aggregate	8.00	☒	No	91,923	BackCalc	91,923	0.35	Fully Bond...	☐	☐	☐
Natural Subgrade	Cohesionless Cut	227.00	☒	No	21,622	BackCalc	21,622	0.40	Fully Bond...	☐	☒	☒
Bedrock	Bedrock		☐				1,000,000	0.50		☐	☐	☐

13.2.7 Results

25. Results from the pavement analysis are displayed in accordance with the selected calculation option.

25

Use LEAGL for PCN

Send to APE - Low Volume

View Coverages

Comments

Calculation Options

Damage

Stresses/Strains

Run Analysis

Results

C-130H Hercules	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACN	PCN	PCN String	ACN/PCN	ACN/PCN Rating	AC Overlay (in.)
▶	130,000	14,401	156,145	114,454	20	25	25/F/A/W/T	0.8	Green	0.0

Use LEAGL for PCR

Send to APE - Low Volume

View Coverages

Comments

Calculation Options

Damage

Stresses/Strains

Run Analysis

Results

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)
▶ C-130H Hercules	130,000	14,400	156,146	114,454	193	231	231/F/A/W/T	0.8	Green	1.0
UH-60	16,600	4,800	14,544	38,151	52	46		0.2	Green	1.0

Use LEAGL for individual vehicles

Send to APE - Low Volume

View Coverages

Comments

Calculation Options

Damage

Stresses/Strains

Run Analysis

Results

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	PCR String	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)
▶ C-130H Hercules	130,000	14,400	156,146	114,454	193	231	231/F/A/W/T	0.8	Green	1.0
UH-60	16,600	4,800	65,637	37,938,251	52	204		0.2	Green	0.0

13.3 LEEP Examples

13.3.1 Evaluate pavements by manually inputting modulus values

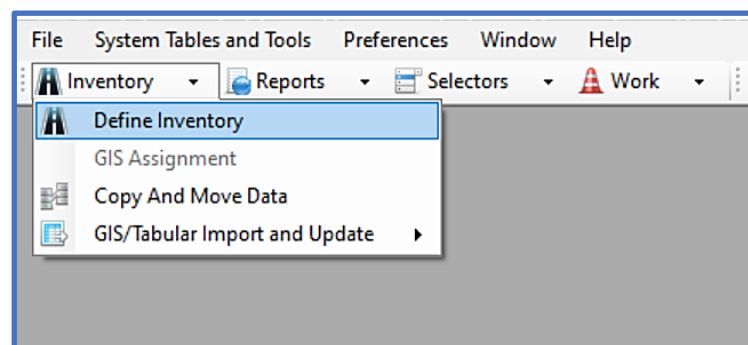
Evaluate the pavements described in Tables 1 and 2.

Table 1.					
Allen Army Airfield, Fort Greely, AK (Service – Army)					
Runway 01-19, Section R03C Surface – fair condition (PCI=60; load distress=20%) Evaluate for Army Class IV > 5,000 ft and < 9,000 ft Use the default values for Poisson's Ratio and Bond					
Material Properties					
Layer Type / Classification	Thickness in. (mm)	Modulus psi (MPa)*	Frost Code	% Moisture	Dry Unit Weight pcf (kg/m ³)
Asphalt Concrete	4.5 (114)	493,194 (3,400)	NFS	0	145 (2,323)
Unbound Aggregate Base	8.0 (203)	83,966 (579)	NFS	5	135 (3,429)
Gravelly Sand & Silt (cohesionless cut)	--	14,179 (98)	F3	10	110 (2,794)
*Backcalculated values from FWD results performed the previous summer					

Allen Army Airfield, Fort Greely, AK; Runway 01-19, Section R03C

Step 1. Define the Inventory

- Click **Inventory** on the toolbar and select **Define Inventory**



- On the Inventory form, select the **Network** tab
- Select **New**
- Type in the **Network ID**, **Network Name**, and **Comments** (optional)

The screenshot shows the 'AAAF' application window with the 'Network' tab selected. The 'Network ID' field contains 'AAAF', the 'Network Name' field contains 'Allen Army Airfield', and the 'Comments' field contains 'Fort Greely, AK'. The 'User Defined Fields' section is empty. At the bottom, the 'You are editing:' section shows 'Current Values' selected, and the 'New' button is highlighted.

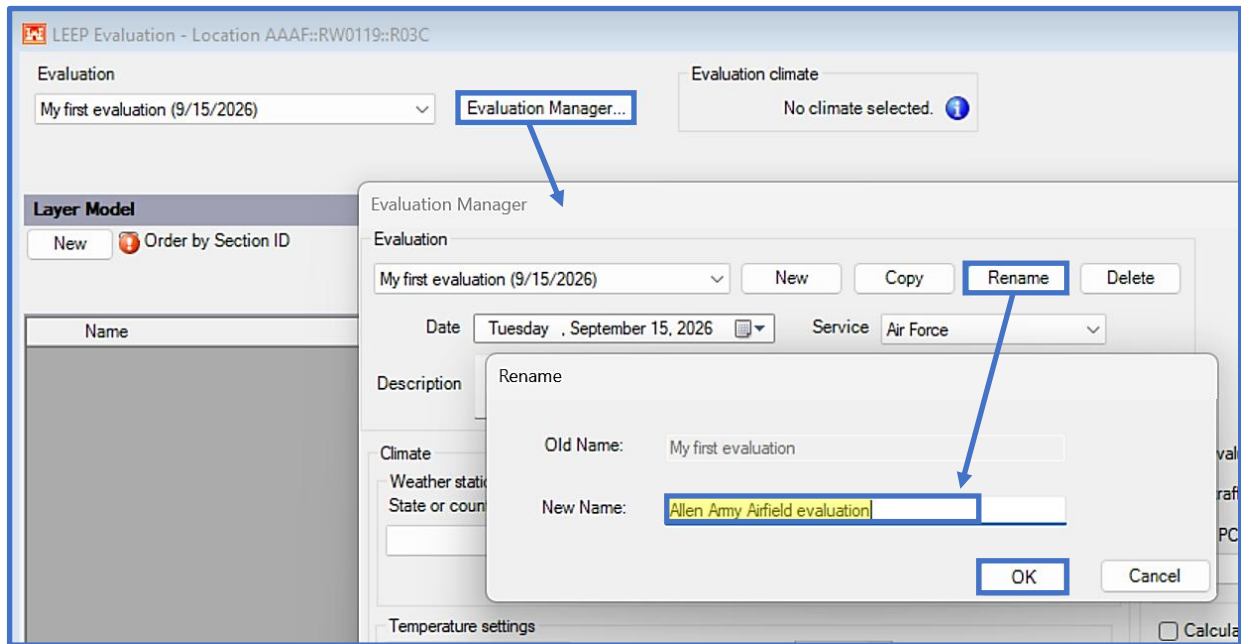
- On the Inventory form, select the **Branch** tab
- Select **New**
- Type in the **Branch ID**, **Branch Name**, and use the pulldown to select the **Branch Use**
- Select **OK**

The screenshot shows the 'AAAF' application window with the 'Branch' tab selected. A 'New Branch' dialog box is open, showing the 'Branch ID' field with 'RW0119', the 'Branch Name' field with 'Runway 01-19', and the 'Branch Use' dropdown menu set to 'RUNWAY'. The dialog box also includes a note '* PAVR Mandatory field' and 'Cancel' and 'OK' buttons. The 'New' button in the background application is also highlighted.

- On the Inventory form, select the **Section** tab
- Select **New**
- Type in the **Section ID**, **Length**, and **Width** (required)
- Type in **From** and **To** (optional)
- Use the pulldown to select the **Constructed** date, **Rank**, and **Surface Type** (required)
- Select **OK**

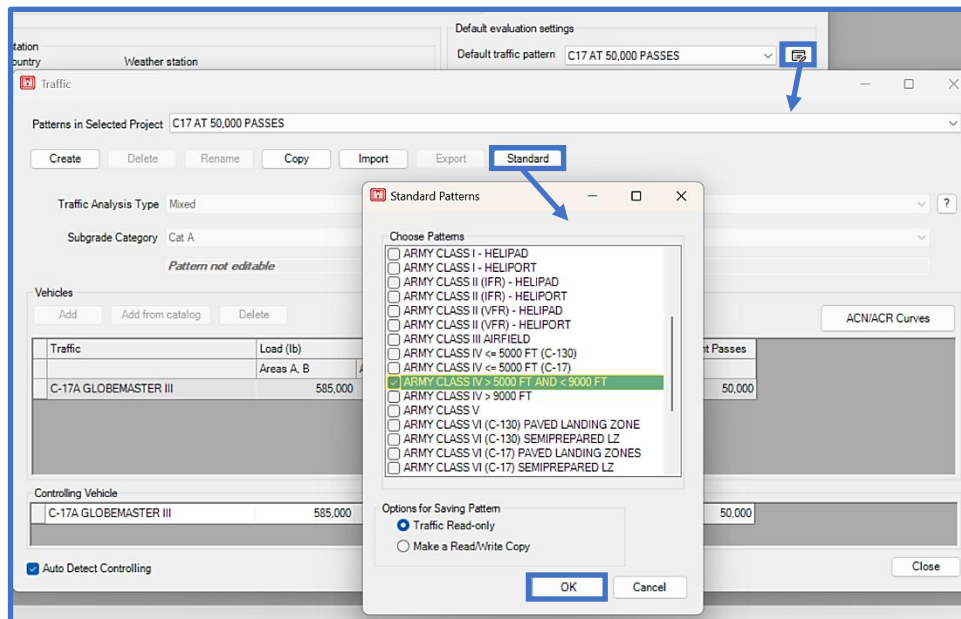
Step 2. Set up the Evaluation

- Select **LEEP** evaluation
- On the LEEP evaluation form; select **Evaluation Manager**
- On the Evaluation Manager form; select **Rename**
- Rename the evaluation “Allen Army Airfield evaluation”
 - Select **Ok**

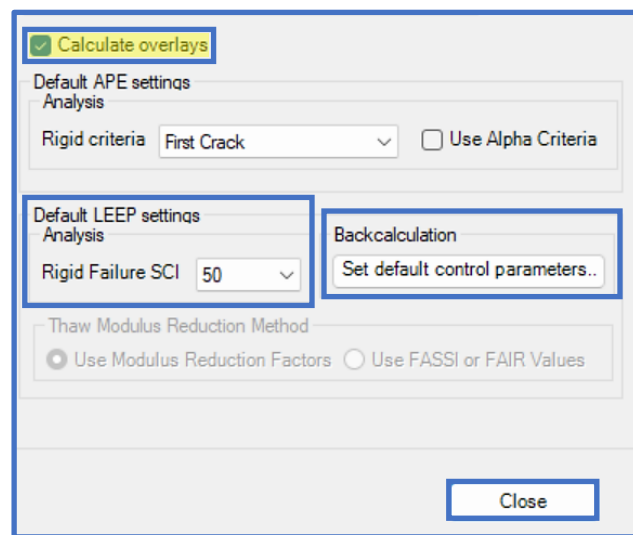


- On the Evaluation Manager form:
 - Select Army from the Service drop-list field
 - Select the appropriate Weather station from the Climate section
 - Check the box for Consider Frost; the Freezing season will populate based on the selected Weather station information

- In the Default evaluation settings section; click on the Default traffic pattern icon 
- On the Traffic form; select Standard
- On the Standard Patterns form; select Army Class IV > 5,000 ft and < 9,000 ft
- Select OK

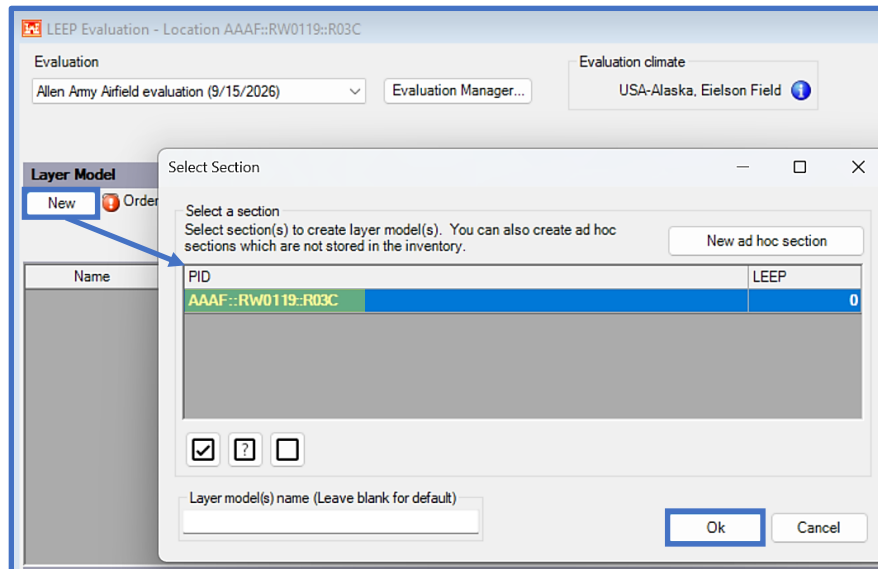


- On the Evaluation Manager form:
 - In Default evaluation settings; check the box for Calculate Overlays
 - Under Default LEEP settings; ensure the Rigid failure SCI is set to 50
 - Backcalculation parameters can be set now, or applied at the section-level from within the LEEP evaluation form
 - Select Close to exit the Evaluation Manager and return to LEEP evaluation

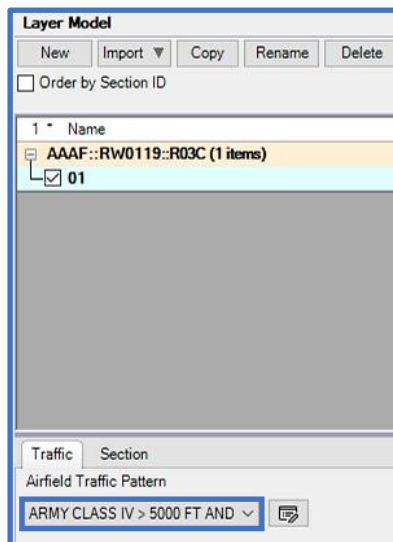


Step 3. Analyze the pavement using LEEP evaluation

- On the LEEP evaluation form; select New
- On the Select Section form; select the appropriate section PID
- Select Ok



- On the LEEP evaluation form, under Layer Model, the selected section populates
- The Traffic tab should display the traffic pattern that was added



- Select the Section tab:
 - Input the PCI and % Load distress values as shown below
 - Select Calculate to display the resultant SCI, Cb, and Cr
 - All other default properties shown are correct, no need for further edits

The screenshot displays the 'Section' tab of the PAVER software interface. The 'Inspection/Analysis' sub-tab is active, showing 'Inspection Data' with input fields for 'PCI' (60) and '% Load-related Distress' (20). Below these is a 'Calculate' button and a row of calculated values: 'SCI' (92), 'Cb' (1), and 'Cr' (0.94). The 'Analysis Structure Parameters' section includes a 'Traffic area' dropdown set to 'Area C', a 'Load frequency' dropdown set to '10 Hz - Runways', and a checked checkbox for 'Evidence of Frost Damage'. A 'Refresh Properties from PAVER Section' button is located at the bottom.

Property	Value
PCI	60
% Load-related Distress	20
SCI	92
Cb	1
Cr	0.94

- Under **Settings**
 - Uncheck **Use Backcalculation**, since modulus values will be entered manually. The **Analysis Options** in the layer model grid should be set to **Manual**. Input **Modulus** values for each layer (see below or Table 1).
 - **Calculate overlays** is checked as indicated in **Evaluation Manager**
 - Under the **Analysis** tab
 - **Flexible** is selected, as indicated in **Define Inventory**
 - The **Design temperature calculation** results display, but will not be used for manual entry of moduli.
 - The **Depth of frost** displays
 - **Use modulus reduction factors** is selected by default for the **Thaw Modulus Reduction Method**

Layer Type	Material Type	Thickness (in.)	Analysis Options	Modulus (psi)
Asphalt Concrete	Asphalt Cement	0.00	Manual	493,194
Base	Unbound Aggregate	0.00	Manual	83,966
Natural Subgrade	Cohesionless Cut	240.00	Manual	14,179
Bedrock	Bedrock			1,000,000

- On the **LEEP evaluation** form, in the **Layers** grid, a default pavement section is displayed
- Input the **Thickness**, **Frost Code**, **Moisture Content**, and **Dry Unit Weight** values for each layer (see below or Table 1).
- Keep the defaults for **Poisson's Ratio** and **Bond**
- Select **LEEP using LEAGL method for PCR** from **Calculation Options**

- Select **Run Analysis**

Layers												
Layer Type	Material Type	Thickness (in.)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade ?	Frost Code	Moisture Content	Dry Weight (lb/ft³)	
▶ Asphalt Concrete	Asphalt Cement	4.50	Manual	493,194	0.35	Fully Bonded	☒	☐	NFS	0	140	
Base	Unbound Aggregate	8.00	Manual	83,966	0.35	Fully Bonded	☐	☐	NFS	5	135	
Natural Subgrade	Cohesionless Cut	227.50	Manual	14,179	0.40	Fully Bonded	☐	☒	F3F4	10	110	
Bedrock	Bedrock			1,000,000	0.50		☐	☐				

+ Add ▲ Change ▲ ▼ ✕ Delete Depth to bedrock Set to 240 in.

Use LEAGL for PCR

View Coverages Comments Calculation Options Damage Stresses/Strains Run Analysis

- Results display

Layers													
Layer Type	Material Type	Thickness (in.)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade ?	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Controlling Layer (AGL)	Controlling Layer (AP)
▶ Asphalt Concrete	Asphalt Cement	4.50	Manual	493,194	0.35	Fully Bonded	☒	☐	NFS	0	140	☐	☐
Base	Unbound Aggregate	8.00	Manual	83,966	0.35	Fully Bonded	☐	☐	NFS	5	135	☐	☐
Natural Subgrade	Cohesionless Cut	227.50	Manual	14,179	0.40	Fully Bonded	☐	☒	F3F4	10	110	☒	☒
Bedrock	Bedrock			1,000,000	0.50		☐	☐				☐	☐

+ Add ▲ Change ▲ ▼ ✕ Delete Depth to bedrock Set to 240 in.

Use LEAGL for PCR

View Coverages Comments Calculation Options Damage Stresses/Strains Run Analysis

Results												
Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)	
▶ C-17A GLOBEMASTER III	Normal (Aug-Apr)	580,000	56,250	188,144	29	517	128	128/F/C/W/T	4.0	Red	12.5	
C-17A GLOBEMASTER III	Thaw-Weakened (M...	580,000	18,750	188,144	10	694	139	139/F/D/W/T	5.0	Red		

Table 2.					
Allen Army Airfield, Fort Greely, AK (Service – Army)					
Apron D, Section A04B Surface – good condition (PCI=80; load distress=10%) Evaluate for Army Class IV > 5,000 ft and < 9,000 ft Use the default values for Poisson's Ratio and Bond					
Layer Type / Classification	Thickness in. (mm)	Modulus psi (MPa)*	Frost Code	% Moisture	Dry Unit Weight pcf (kg/m³)
Portland Cement Concrete Flex strength = 650 psi (4.48 MPa)	12 (305)	7,530,519 (51,921)	NFS	0	145 (2,323)
Base Sandy Gravel (GW)	8 (203)	286,487 (1,975)	NFS	5	135 (3,429)
Gravelly Sand & Silt (cohesionless cut)	--	26,658 (184)	F3	10	110 (2,794)
*Backcalculated values from FWD results performed the previous summer					

Allen Army Airfield, Fort Greely, AK; Apron D, Section A04B

Step 1. Define the Inventory

- On the Inventory form, in the same Network, select the Branch tab again
 - Select New
 - Type in the Branch ID, Branch Name, then select the Branch Use from the drop-list, as shown below
 - Select OK

The screenshot shows the 'Inventory (AAAF:RW0119:R03C)' application window. The 'Branch' tab is selected. A 'New Branch' dialog box is open, allowing the user to define a new branch. The dialog box contains the following fields and options:

- Branch ID:** A text field containing 'APD'.
- Branch Name:** A text field containing 'Apron D'.
- Branch Use:** A dropdown menu with 'APRON' selected.
- *PAVER Mandatory field:** A section for paver-related data, currently empty.
- Buttons:** 'Cancel' and 'OK' buttons are at the bottom right of the dialog box.
- Main Window:** The background shows the 'Inventory' form with various summary statistics (Sum of Section Lengths, Sum of True Section Areas, Branch True Area) and a 'Comments' field. At the bottom of the main window, there are buttons for 'New', 'Copy', 'Delete', and 'Close', along with radio buttons for 'Current Values' and 'Historical Inspection Values'.

A blue arrow points from the 'New' button in the main window to the 'New Branch' dialog box, indicating the next step in the process.

- On the inventory form, select the **Section** tab
 - Select **New**
 - Type in the **Section ID**, **Length**, and **Width** (required)
 - Type in **From**, **To** and **Slab Data** (optional)
 - Use the drop-lists to select the **Constructed** date, **Rank**, and **Surface Type** (required)
 - Select **OK**
 - Close the inventory form

The screenshot shows the 'Inventory (AAAF:APD)' application window with the 'Section' tab selected. A 'New Section' dialog box is open, allowing the user to enter details for a new section. The fields in the dialog box are as follows:

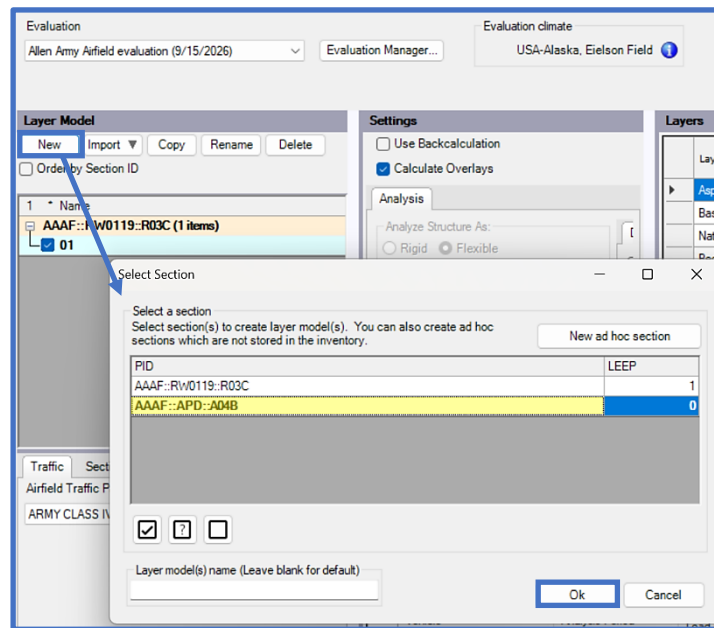
- Section ID:** A04B
- From:** (empty)
- To:** (empty)
- Constructed:** 9/15/2026
- Length:** 1
- Width:** 1 Ft
- Rank:** P
- Surface Type:** PCC
- True Area:** 1 SqFt
- Slab Data:**
 - Slab Length (Typical): (empty)
 - Slab Width: (empty) Ft

The 'OK' and 'Cancel' buttons are at the bottom right of the dialog box. In the main window, the 'New' button at the bottom center is highlighted with a blue box, and a blue arrow points from it to the 'New Section' dialog box.

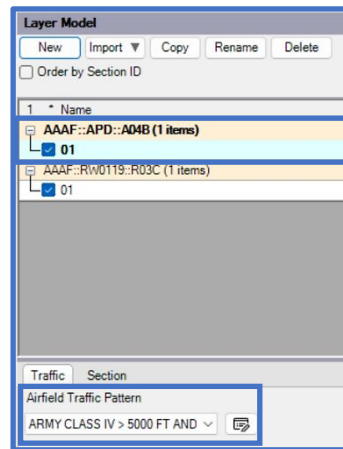
Evaluation Manager (Step 2) was accomplished in the previous example (Runway 01-19, Section R03C); proceed to Step 3.

Step 3. Analyze the pavement using **LEEP evaluation**

- On the **LEEP evaluation** form; select **New**
- On the **Select Section** form; select the appropriate section **PID**
- Select **Ok**



- On the LEEP evaluation form, under Layer Model, the newly added section populates
- Confirm that the traffic pattern is still set to Army Class IV > 5000 FT and < 9000 FT



- Select the Section tab:
 - Input the PCI and % Load-related Distress values as shown below
 - Select Calculate to display the resultant SCI, C_b , and C_r
 - All other properties shown are correct, no need for further edits

The screenshot shows the 'Layer Model' dialog box. At the top, there are buttons for 'New', 'Import', 'Copy', 'Rename', and 'Delete'. Below these is a checkbox for 'Order by Section ID'. The main area is a tree view showing a hierarchy of sections. The first level is '1 * Name'. Under it, there are two sections: 'AAAF::APD::A04B (1 items)' and 'AAAF::RW0119::R03C (1 items)'. Both sections have a sub-item '01' which is checked. Below the tree view, there is a 'Traffic' tab and a 'Section' tab. The 'Section' tab is active, showing 'Inspection/Analysis' and 'Inventory Properties' sub-tabs. The 'Inspection/Analysis' sub-tab is active, showing 'Inspection Data' with fields for 'PCI' (80) and '% Load-related Distress' (10). There is a 'Calculate' button and a row of calculated values: 'SCI' (98), 'Cb' (1), and 'Cr' (0.99). Below this is the 'Analysis Structure Parameters' section, which includes a 'Traffic area' dropdown menu set to 'Area B' and a checked checkbox for 'Evidence of Frost Damage'. At the bottom, there is a button labeled 'Refresh Properties from PAVER Section'.

- Under Settings
 - Use Backcalculation is unchecked since modulus values will be entered manually
 - Calculate overlays is checked as indicated in Evaluation Manager
 - Under the Analysis tab
 - Rigid is selected, as indicated in Define Inventory
 - Use the defaults for Load transfer
 - Set the Failure SCI to 50 (for Army analysis)
 - The Depth of Frost displays
 - Use modulus reduction factors is selected by default for the Thaw Modulus Reduction Method
 - Under the Overlay tab
 - The Rigid settings section displays the SCI, Cb, and Cr calculated in the Edit Section form
 - Use the default PCC Overlay Flex strength and Modulus values

Settings

☐ Use Backcalculation

☒ Calculate Overlays

Analysis **Overlay**

Analyze Structure As:

☒ Rigid ☐ Flexible

Failure SCI 50 ?

Load transfer

% Load Transfer 25 ☒

Joint Deflection Ratio 0.76 ☐

Max Edge Stress 75 %

Depth of Frost Thaw Season

☐ Override calculated frost

115 in.

Thaw Modulus Reduction Method

☐ Use FASSI or FAIR values

☒ Use modulus reduction factors

Settings

☐ Use Backcalculation

☒ Calculate Overlays

Analysis **Overlay**

Rigid settings

SCI Cb Cr

98 1 0.99

PCC Overlay

Flex strength

650 psi

Modulus

4000000 psi

?

- On the LEEP evaluation form, in the Layers grid, a default pavement section displays
- Input values for Thickness, Modulus, Frost Code, Moisture Content, and Dry Unit Weight for each layer (see below or reference Table 2)
- Use the defaults for Poisson's Ratio and Bond
- Select LEEP using LEAGL method for PCR in Calculation Options
- Select Run Analysis

Layers

Layer Type	Material Type	Thickness (in.)	Flex Strength (psi)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade ?	Frost Code	Moisture Content	Dry Weight (lb/ft³)
Portland Cement Concrete	Portland Cement	12.00	650	Manual	7,530,519	0.15	Partially Bonded	☒	☐	NFS	0	145
Base	Unbound Aggregate	8.00		Manual	286,487	0.35	Fully Bonded	☐	☐	NFS	5	135
Natural Subgrade	Cohesionless Cut	220.00		Manual	26,658	0.40	Fully Bonded	☐	☒	F3F4	10	110
Bedrock	Bedrock				1,000,000	0.50		☐	☐			

☒ Add
 ☒ Change
 ☐ Up
 ☐ Down
 ☐ Delete
 Depth to bedrock Set to 240 in.

☒ Use LEAGL for PCR

View Coverages View F Factors Comments **Calculation Options** Damage Stresses/Strains **Run Analysis**

- Results display
- Select **Close** to exit LEEP

Layer Type	Material Type	Thickness (in.)	Flex Strength (psi)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade ?	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Equivalent PCC Thickness (in.)	Weighted PCC Flex Strength (psi)
Portland Cement Concrete	Portland Cement	12.00	650	Manual	7,530,519	0.15	Partially Bonded	☒	☐	NFS	0	145	12.00	650
Base	Unbound Aggregate	8.00		Manual	286,487	0.35	Fully Bonded	☐	☐	NFS	5	135		
Natural Subgrade	Cohesionless Cut	220.00		Manual	26,658	0.40	Fully Bonded	☐	☒	F3F4	10	110		
Bedrock	Bedrock				1,000,000	0.50		☐	☐					

Depth to bedrock:

Use LEAGL for PCR

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)	PCC Nonbonded (in.)	PCC Partially Bonded (in.)	PCC Fully Bonded (in.)
C-17A GLOBEMASTER III	Normal (Aug-Apr)	580,000	56,250	322,220	413	481	234	234/R/A/W/T	2.1	Red	8.9	14.5	11.0	6.8
C-17A GLOBEMASTER III	Thaw-Weakened (M...	580,000	18,750	322,220	138	722	299	299/R/D/W/T	2.4	Red				

13.3.2 Evaluate pavements using DCP results

Evaluate the pavement Section A01B, Branch APMAIN, at Stallion AAF, using the DCP results from example [16.3.2 Manual Data Entry of DCP Data and Performing Analysis](#) and parameters provided in Table 3.

Table 3.		
Stallion AAF, White Sands, NM (Service – Army)		
APMAIN, Section A01B Surface pavement – Flexible Pavement structure from DCP results; reference Example 16.3.2 Frost is not a consideration Calculate overlays		
Traffic		
Aircraft	Weight – A, B [lb (kg)]	Passes – A, B, C
C-130H	130,000 (58,967)	14,400
UH-60	16,600 (7,530)	4,800

Step 1. Open the database containing the DCP data and analysis

Step 2. Open LEEP evaluation

Step 3. Define traffic and settings

- Select Evaluation Manager
 - Select Army for the Service
 - Select the Weather Station as shown below (*optional since Frost is not a consideration and FWD data is not being used*)
 - On the Evaluation Manager form, under Default evaluation settings; click on the Default traffic pattern icon 
 - On the Traffic form; select Create
 - Name the pattern “Stallion AAF”
 - Select Airfield for the Pavement use
 - Click Ok
 - Under Vehicles select Add from catalog
 - Type “C-130H” in the search field and select the vehicle, then do the same for the “UH-60”
 - Click Add Selected
 - Enter the Load and Passes indicated in Table 3

Note: On the Traffic form, for a mixed analysis; select the subgrade category (from the DCP analysis), traffic area, and pavement type to display the controlling vehicle and equivalent passes. This is optional, since this process may also be performed in the APE form/analysis.

 - To exit the traffic form; select Close
 - To exit the Evaluation Manager; select Close

Evaluation Manager

Evaluation

Stallion AAF, NM (8/18/2026) [New] [Copy] [Rename] [Delete]

Date: Wednesday, September 16, 2026 [Service: Army]

Description: [] Comments: []

Climate

Weather station

State or country: USA-New Mexico Weather station: White Sands NM [Weather station info] [Month Readings...] [Map]

Temperature settings

Set 5 day mean... Design Air Temperature: 88.7 °F

☐ Consider Frost

Default evaluation settings

Default traffic pattern: C17 AT 50,000 PASSES []

Report PCR Using Vehicle: []

☐ Calculate overlays

Default APE settings

Analysis

Rigid criteria: First Crack ☐ Use Alpha Criteria

Default LEEP settings

Analysis

Rigid Failure SCI: 50 Backcalculation: Set default control parameters..

Thaw Modulus Reduction Method

☒ Use Modulus Reduction Factors ☐ Use FASSI or FAIR Values

[Mark as historical] [Close]

Traffic

Patterns in Selected Project: C17 AT 50,000 PASSES

[Create] [Delete] [Rename] [Copy] [Import] [Export]

Traffic Anal: []

Subgrade: []

Vehicles

Add

Traffic Load (lb) Passes

Create New Traffic Pattern

Pattern Name: Stallion AAF

Pavement Use: Airfield

[OK] [Cancel]

Vehicle catalog

Vehicle Filter

Search in name, category, standard load

Available vehicles

Helicopter
UH-60
Standard load 16,300 lb

Selected vehicles

C-130H Hercules

Click on a vehicle to move it to the Selected vehicles section

Traffic

Patterns in Selected Project: Stallion AAF

Create Delete Rename Copy Import Export Standard

Traffic Analysis Type: Mixed Traffic Area: Traffic Area A

Subgrade Category: Cat A Pavement Type: Flexible Pavement Use: Airfield

Vehicles

Add Add from catalog Delete

Traffic	Load (lb)		Passes		Equivalent Passes
	Areas A, B	Areas C, D	Areas A, B, C	Area D	
C-130H Hercules	130,000	97,500	14,400	144	14,400
UH-60	16,600	12,450	4,800	48	1

ACN/ACR Curves

Controlling Vehicle

C-130H Hercules	130,000	97,500	14,400	144	14,401
-----------------	---------	--------	--------	-----	--------

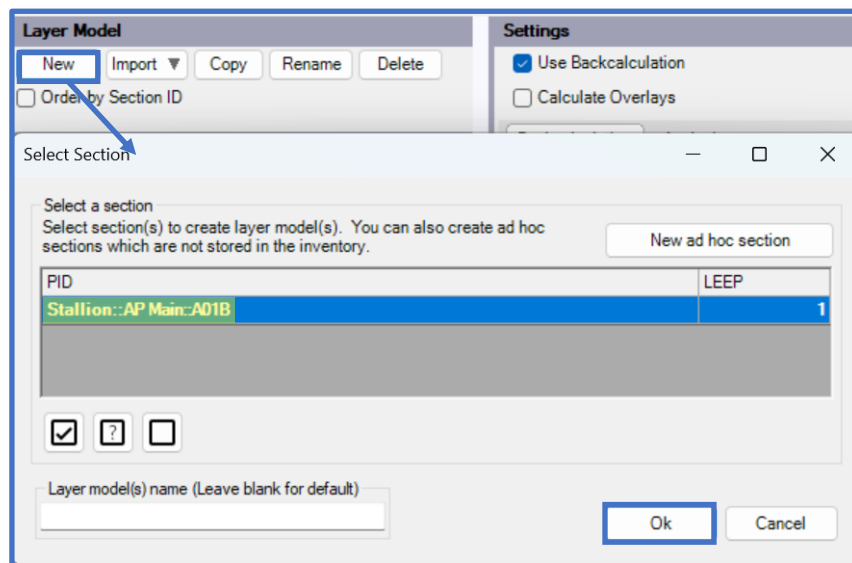
Auto Detect Controlling

Close

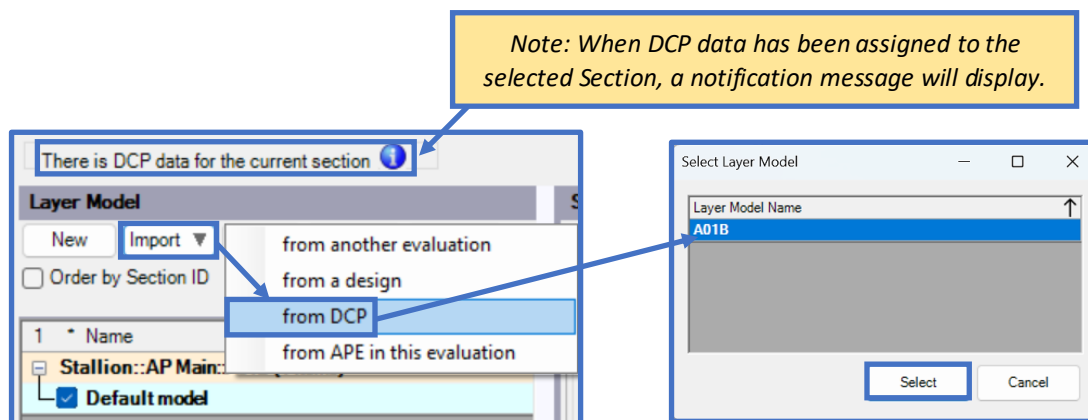
For Mixed Analysis, the Controlling Vehicle and Equivalent Passes are based on the Subgrade Category, Traffic Area, and Pavement Type.

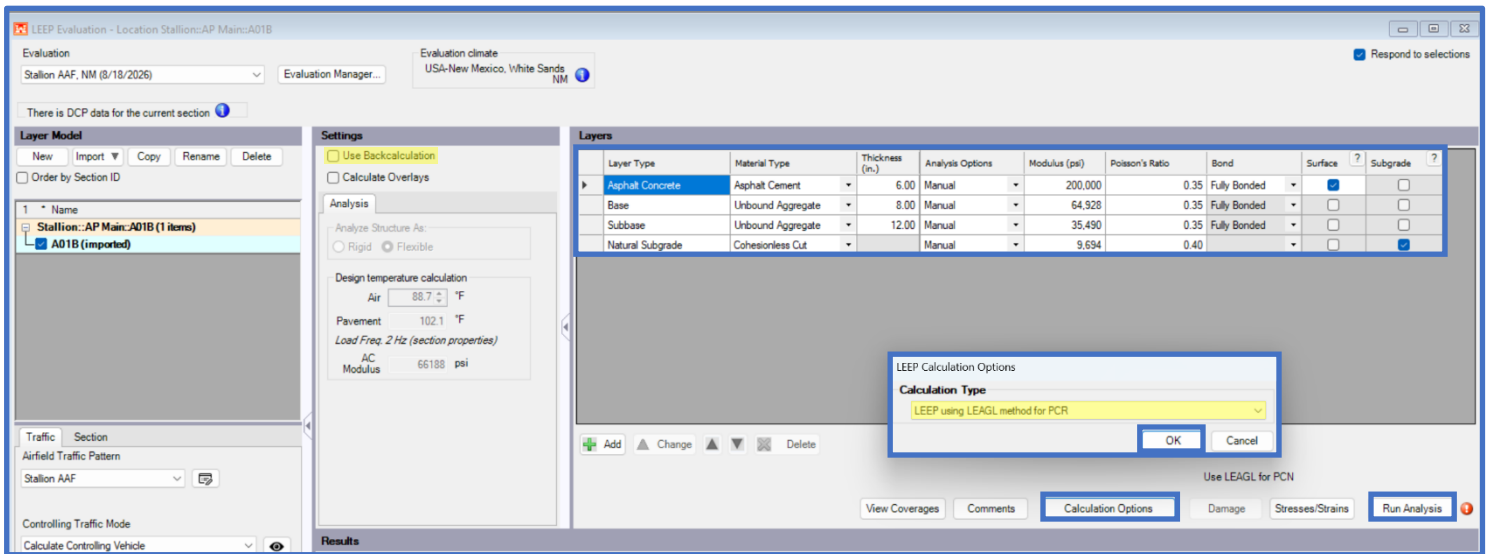
Step 4. Import DCP data

- On the LEEP evaluation form, under Layer Model; select New
 - On the Select Section form; select STALLION::PAMAIN::A01B
 - Select Ok to exit the Select Section form



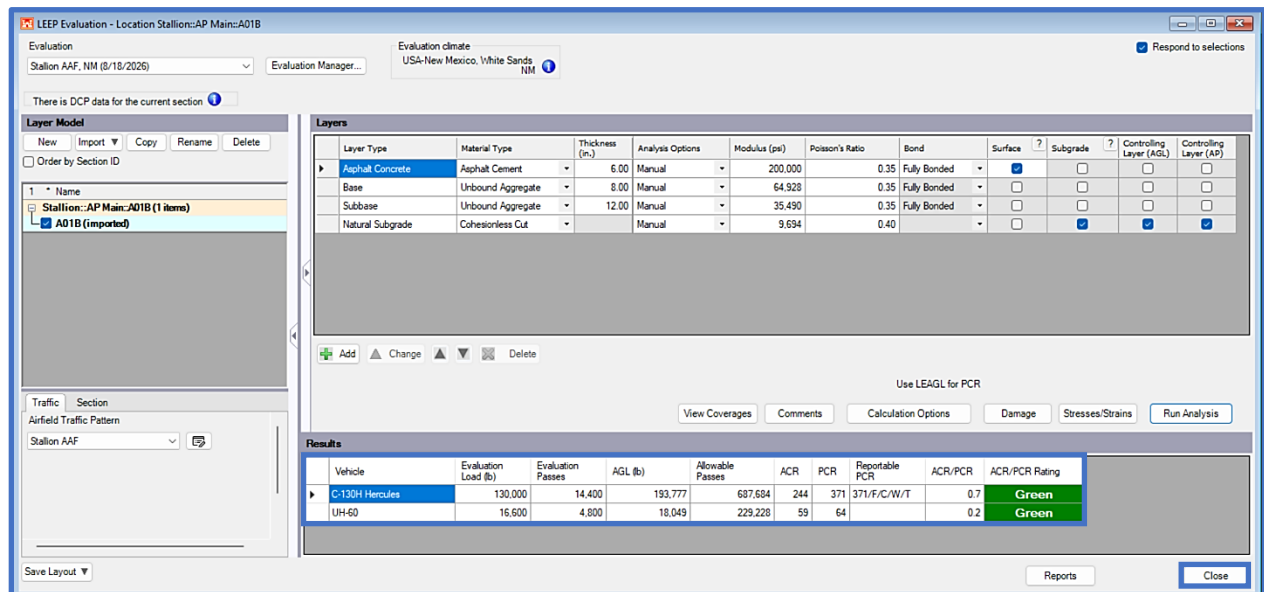
- On the LEEP evaluation form, under Layer Model
 - Use the Import menu to select from DCP
- On the Select Layer Model form
 - Select A01B
 - Click on Select to exit the form
- The imported layer model populates
- Select the imported model and delete the “Default model” if so desired





Step 5. Run Analysis

- Ensure Use Backcalculation is unchecked
- Select LEEP using LEAGL method for PCR in Calculation Options
- Select Run Analysis
- Results are displayed in the Results grid



- To exit LEEP; select Close

13.3.3 Evaluate pavements using backcalculated modulus values

Evaluate the pavement Section R01A, Branch RW1432, at Stallion AAF, using the FWD results from example [15.3.1 Perform Analysis of Pavement Using Deflection Basin Data](#) and the parameters provided in Table 4.

Table 4.			
Stallion AAF, White Sands, NM (Service – Army)			
RW1432, Section R01A Evaluation date – 06/26/2019 Surface pavement – Satisfactory condition (PCI=82; load distress=32%) Evaluate for Stallion traffic pattern (see Example 13.3.2) and Air Force 14 Groups New Frost is not a consideration Calculate overlays			
Layer Type	Material Type	Thickness In. (mm)	Modulus psi (MPa)
AC Overlay	Asphalt Cement	3 (76.2)	
Asphalt Cement	Asphalt Cement	2 (50.8)	*
Base	Unbound Aggregate	8 (203.2)	*
Natural Subgrade	Cohesive cut	227 (5,765.8)	*
Bedrock	Bedrock	--	--
* Modulus values backcalculated from FWD data explained in Example 15.3.1			

In [Example 15.3.1](#) Step 11, all of the .FWD deflections (for all stations) of Drop 3 were assigned to Section R01A. Perform the following steps to complete the evaluation analysis.

Step 1. Use previously imported data or create a new database – reference Chapter 2 File Menu, [Section 2.1.1 New/import pavement database](#).

Step 2. Verify existing or create a new pavement section Inventory (Network: Stallion; Branch: RW1432; Section: R01A) – reference Chapter 2 File Menu, [Section 2.14 PCASE Data Assignment](#).

Step 3. Evaluation Checklist

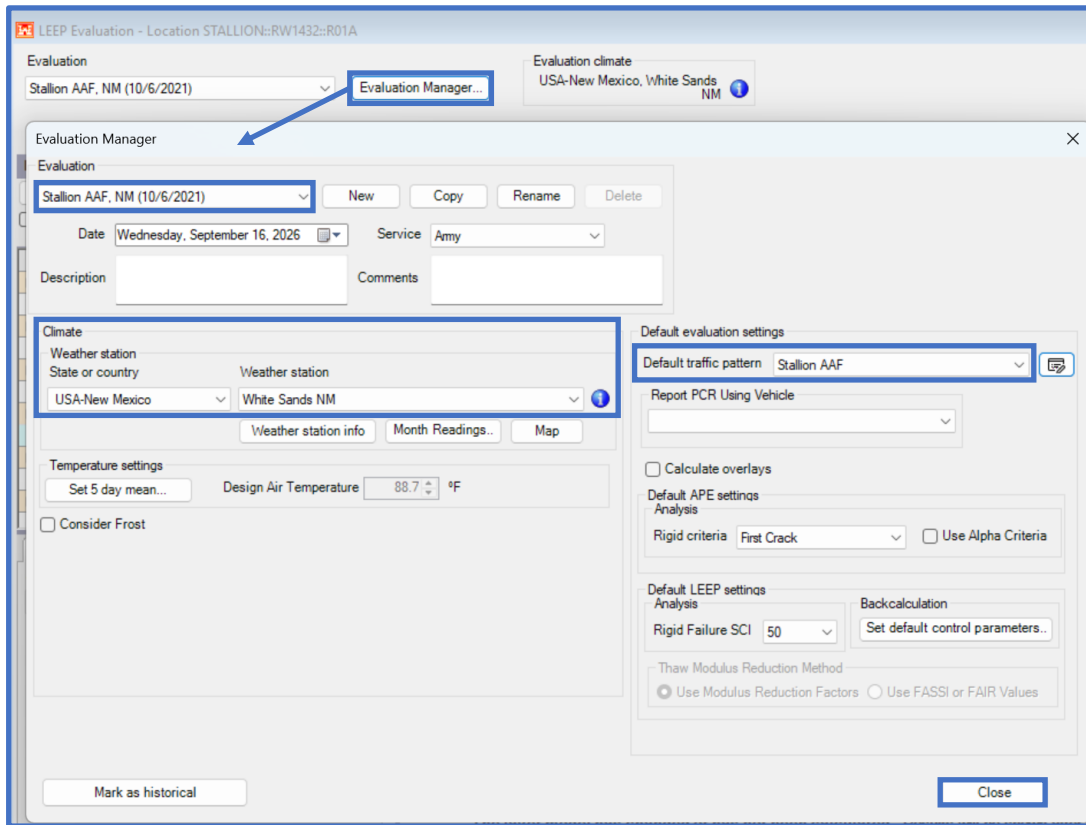
- Open Evaluation Checklist
- In Evaluation checklist; select Add all sections to add R01A.
- Select Close to exit.

The screenshot shows the 'Evaluation checklist' window. The 'Evaluation' section has a dropdown menu set to 'Stallion AAF, NM (6/26/2019)' and an 'Evaluation Manager...' button. The 'Sections' section has a 'Drag column here to group by' label and a table with the following data:

Section Name	Ad hoc	Surface type	Use
STALLION::RW 1432::R01A	☐	AC	RUNWAY

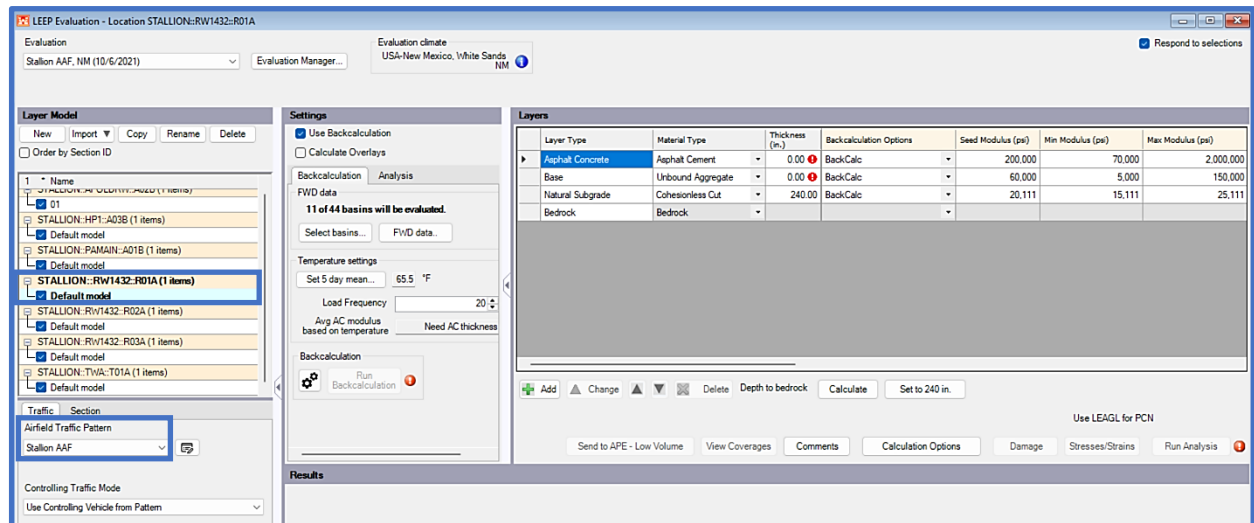
Below the table are buttons for 'Edit section properties', 'Refresh section properties', and 'Reports'. The 'Manage Sections in Evaluation' section contains buttons for 'Add all sections', 'Add subset of sections', and 'Add ad-hoc section'. A 'Close' button is located at the bottom right of the window.

- Select Evaluation Manager
- Verify the evaluation parameters (i.e., Evaluation Name, Date, Traffic, Calculate Overlays, Climate data, Backcalculation Control Parameters) as shown below, make changes where needed.
- Select Close to exit.



Step 4. LEEP evaluation

- Open LEEP and verify that R01A was added to the evaluation.



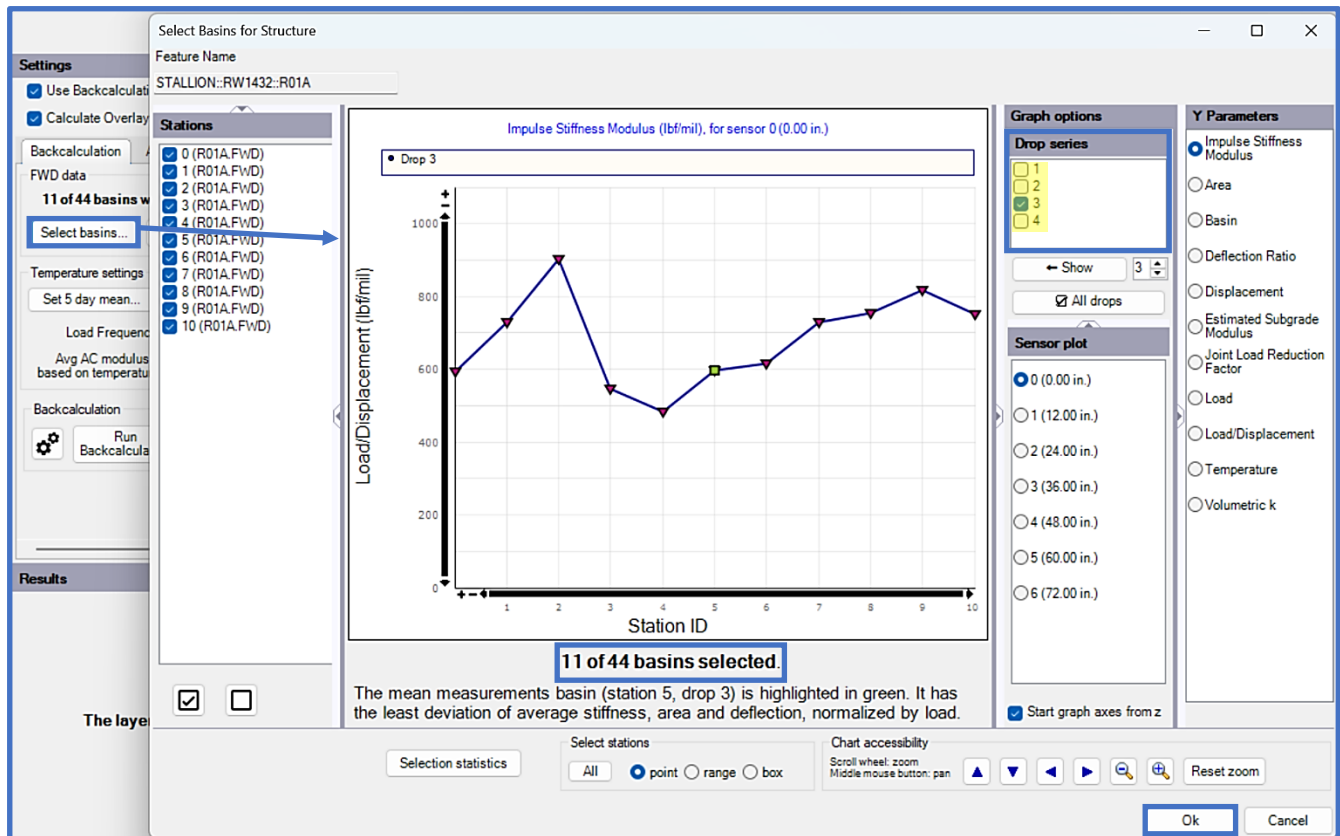
- Check Section information by selecting the Section tab
 - Edit the PCI, % Load-related Distress for overlay coefficient calculation
 - Confirm the applicable Load Frequency is selected, in the case that Analysis Option: Temperature will be selected during evaluation. This section is part of a runway, so Load Frequency: 10- Runways will be selected.

The screenshot shows a software interface with the following elements:

- Tabs:** 'Traffic' and 'Section' (selected).
- Sub-tabs:** 'Inspection/Analysis' (selected) and 'Inventory Properties'.
- Inspection Data:**
 - PCI: 82
 - % Load-related Distress: 32
 - Calculate** (highlighted button)
 - SCI: 94.24
 - Cb: 1
 - Cr: 0.96
- Analysis Structure Parameters:**
 - Traffic area: Area A (dropdown menu)
 - Load frequency: 10 Hz - Runways (dropdown menu)
- Buttons:** 'Refresh Properties from PAVER Section' at the bottom.

- In Settings
 - Check the box for Use Backcalculation
 - Check the box for Calculate Overlays
 - In the case that the Backcalculation Option: Temperature (avg) or Temperature (per drop) may be used during backcalculation, then enter the temperature data under Set 5 day mean... This section is part of the runway, so Load Frequency 10 Hz will be selected.
 - Open the Backcalculation Settings form. Select the values for all Parameter thresholds as shown. Select Apply and close the form.

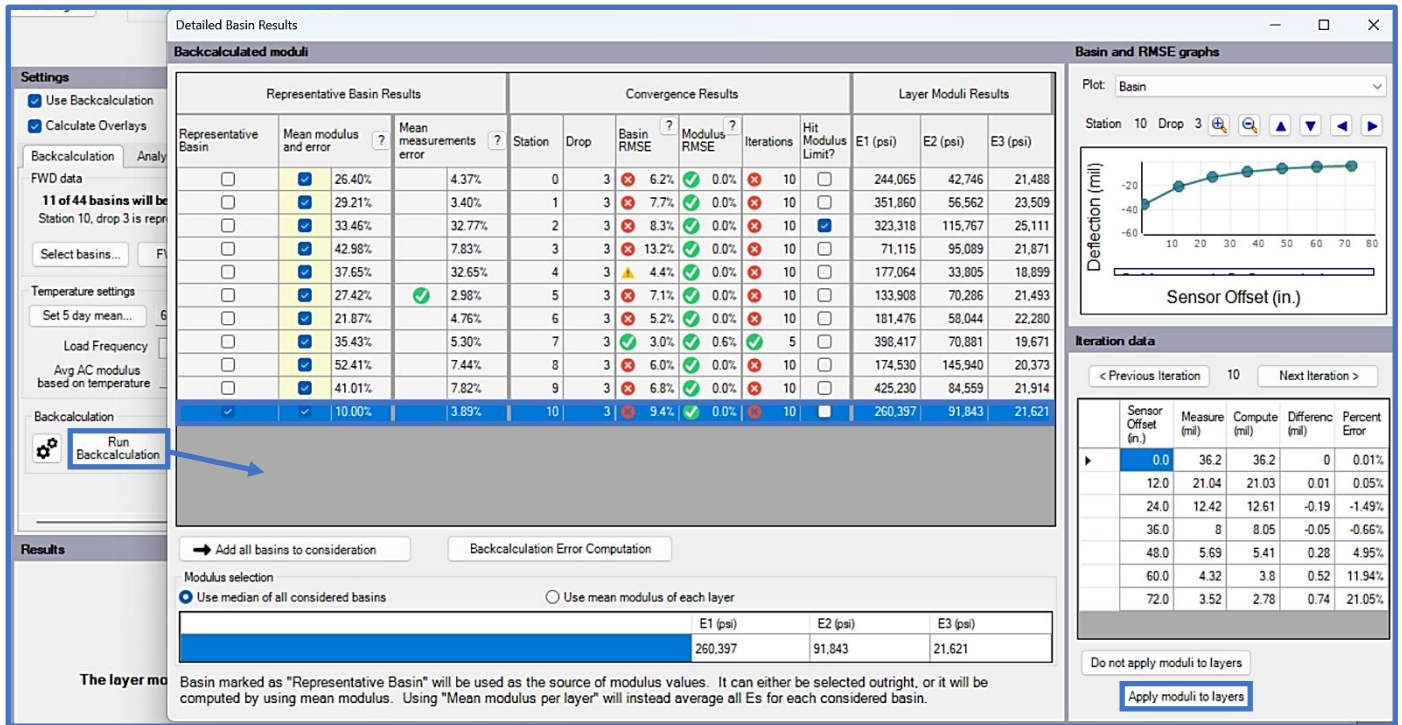
- Return to the Backcalculation tab
 - Select Select basins...
 - On the Select Basins for Structure form, turn off (deselect) Drop series 1, 2, and 4.
 - The form now displays “11 of 44 basins selected.”
 - Select **Ok**



- Within the **Layers** section of the form, verify the **Layer Type** and **Material Type** and enter the **Thickness** for each layer.
- Under **Backcalculation Options**, verify **Back Calc** is selected for each layer in the structure. This signifies that the backcalculation computational routine will be used for all layers.
- Review and modify **Seed Modulus**, **Min Modulus**, and **Max Modulus** for all layers, per engineering judgement. For this example, the default values will be employed.
- Make selection for **Apply Limit** criteria. For this example, the default selection for all layers will be used.
- **Modulus Hit Limit?** and **Backcalculated Modulus** are output fields. These will be reviewed after the backcalculation is completed.
- For **Analysis Options**, ensure **BackCalc** is selected for all layers. The backcalculated values obtained from the computation routine will be transposed to the **Modulus** field for use during analysis to obtain the final results (e.g., AGL, Allowable Passes, etc.).
- Review the **Poisson's Ratio** values. For this example, the default values will be used.
- Select the **Bond** condition. This is flexible pavement, so the default **Fully Bonded** option will be used for all layers.
- Review and verify the **Surface** and **Subgrade** analysis criteria. For this example, the default selections will be used. **Controlling Criteria** is an output field and will be reviewed after the analysis is completed.

Layers																
	Layer Type	Material Type	Thickness (in.)	Back-calculation Options	Seed Modulus (psi)	Min Modulus (psi)	Max Modulus (psi)	Apply Limit	Modulus Hit Limit?	Back-calculated Modulus (psi)	Analysis Options	Modulus (psi)	Poisson's Ratio	Bond	Surface ?	Subgrade
	Asphalt Concrete	Asphalt Cement	5.00	BackCalc	200,000	70,000	2,000,000	☒	No	0	BackCalc	0	0.35	Fully Bond...	☒	☐
▶	Base	Unbound Aggre...	8.00	BackCalc	60,000	5,000	150,000	☒	No	0	BackCalc	0	0.35	Fully Bond...	☐	☐
	Natural Subgrade	Cohesive Cut	227.00	BackCalc	20,111	15,111	25,111	☒	No	0	BackCalc	0	0.40	Fully Bond...	☐	☒
	Bedrock	Bedrock						☐				1,000,000	0.50		☐	☐

- On the **Backcalculation** tab, select **Run Backcalculation**.
- Select **Add all basins to consideration**. The backcalculation routine identified the last station as the Representative Basin. For this example, the engineer will use these backcalculated results for the analysis. The backcalculated results identified are E1: 260,397 psi, E2: 91,843 psi, E3: 21,621 psi. Select **Apply moduli to layers**.



- Under the **Layers** sub-form, the backcalculation output fields are now populated. The **Backcalculated Modulus** and **Modulus** fields reflect the moduli values selected (in this case, from the Representative Basin) after the backcalculation routine. The **Modulus Hit Limit?** field shows that no limits were met or exceeded during backcalculation of this specific basin.

Layers											
Layer Type	Material Type	Thickness (in.)	Backcalculation Options	Seed Modulus (psi)	Min Modulus (psi)	Max Modulus (psi)	Apply Limit	Modulus Hit Limit?	Backcalculated Modulus (psi)	Analysis Options	Modulus (psi)
Asphalt Concrete	Asphalt Cement	5.00	BackCalc	202,290	70,000	2,000,000	☒	No	260,397	BackCalc	260,397
Base	Unbound Aggregate	8.00	BackCalc	60,000	5,000	150,000	☒	No	91,843	BackCalc	91,843
Natural Subgrade	Cohesive Cut	227.00	BackCalc	20,111	15,111	25,111	☒	No	21,621	BackCalc	21,621
Bedrock	Bedrock						☐				1,000,000

- Select LEEP using LEAGL method for PCR in Calculation Options
- At this point, all necessary and applicable parameters are populated for a complete analysis. Select Run Analysis to obtain output for the Airfield Traffic Pattern: Stallion. Results are displayed in the Results sub-form. The subgrade is shown to be the Controlling Criteria layer.

The screenshot shows the 'LEEP Evaluation - Location STALLION:RW1432:R01A' window. The 'Evaluation' dropdown is set to 'Stallion AAF, NM (10/6/2021)'. The 'Evaluation climate' is 'USA-New Mexico, White Sands NM'. The 'Layer Model' section on the left lists several basins, with 'STALLION:RW1432:R01A (1 items)' selected. The 'Settings' section has 'Use Backcalculation' and 'Calculate Overlays' checked. The 'Layers' table shows the subgrade structure:

Layer Type	Material Type	Thickness (in.)	Backcalculation Options	Seed Modulus (psi)	Min Modulus (psi)	Max Modulus (psi)	Apply Limit	Modulus Hit Limit?	Backcalculation Modulus (psi)
Asphalt Concrete	Asphalt Cement	5.00	BackCalc	202,290	70,000	2,000,000	☒	No	
Base	Unbound Aggregate	8.00	BackCalc	60,000	5,000	150,000	☒	No	
Natural Subgrade	Cohesive Cut	227.00	BackCalc	20,111	15,111	25,111	☒	No	
Bedrock	Bedrock						☐		

The 'Results' table at the bottom shows the following data:

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)
C-130H Hercules	130,000	14,400	163,450	180,764	227	285	285/F/B/W/T	0.8	Green	1.0
UH-60	16,600	4,800	15,224	60,255	57	52		0.2	Green	1.0

- Finally, change the Airfield Traffic Pattern to 14 Groups by opening the traffic form and selecting the 14 Groups traffic pattern from Standard Patterns.
- Select 14 Groups from the Airfield Traffic Pattern drop-list.
- Select LEEP using LEAGL method for individual vehicles from Calculation Options.
- Select Group 10 (585,000 lb. 50,000) from the Report PCR Using Vehicle field.
- Select Run Analysis. The results display the Reportable PCR for Group 10 @ 50,000 passes.

The screenshot shows the 'LEEP Evaluation' window with the 'Airfield Traffic Pattern' dropdown set to '14 GROUPS Copy'. The 'Report PCR Using Vehicle' dropdown is set to '*GROUP10 (585,000 lb. 50,000)'. The 'Results' table shows the following data for Group 10:

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)
*GROUP10	585,000	50,000	362,527	645	433	245	245/F/B/W/T	1.8	Red	3.3
*GROUP10	585,000	15,000	398,199	645	433	273		1.8	Red	2.5
*GROUP10	585,000	3,000	453,144	645	433	318		1.8	Red	1.6
*GROUP10	585,000	500	617,687	645	433	465		1.8	Red	1.0
*GROUP11	840,000	50,000	775,858	19,650	276	251		1.1	Green	1.0
*GROUP11	840,000	15,000	859,996	19,650	276	284		1.1	Green	1.0
*GROUP11	840,000	3,000	991,312	19,650	276	338		1.1	Green	1.0
*GROUP11	840,000	500	1,368,843	19,650	276	532		1.1	Green	1.0
*GROUP12	775,000	50,000	281,651	25	787	235		3.2	Red	8.4
*GROUP12	775,000	15,000	285,061	25	787	257		3.2	Red	7.4
*GROUP12	775,000	3,000	330,200	25	787	288		3.2	Red	6.3

14 APE Evaluation

APE Evaluation is capable of analyzing pavements using the empirical method producing resultant allowable loads, passes, Pavement Classification Numbers (PCN), and overlay requirements.

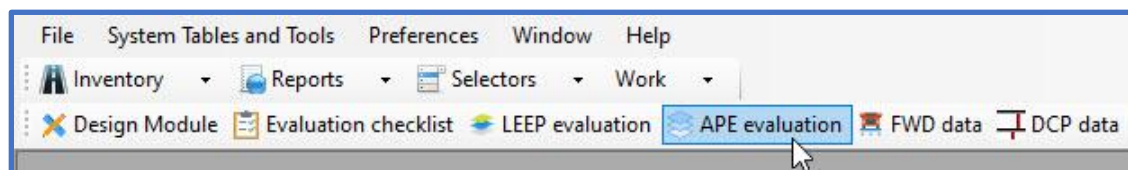
Prior to beginning a new evaluation, ensure that you have opened or created a database to store the evaluation within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference [Chapter 2 File Menu](#).

Prior to using APE evaluation, ensure you have defined your inventory (unless you will be creating sections Ad Hoc); reference [Chapter 7 Inventory](#).

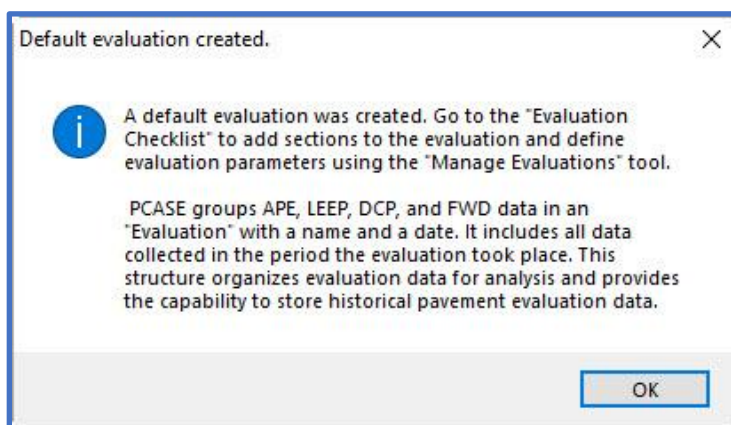
The asset inventory should be initialized prior to using the APE evaluation form; reference [Chapter 12 Evaluation checklist](#).

14.1 Getting Started

Select APE evaluation on the PCASE 7 tool bar to open the Airfield Pavement Evaluation (APE) tool.



If you have not imported or created an evaluation in the current database, the message below pops up indicating a default evaluation was created. Click OK to continue and open the APE evaluation.



14.2 APE Evaluation form

The APE evaluation form is displayed below. To run an APE evaluation, you will go through various sub-sections of the form to modify the default analysis conditions, if desired. The sub-sections are Evaluation Manager, Layer Model, Traffic and Sections, Settings, and Layers. The analysis output results are displayed within Results. Select Close to exit APE evaluation.

The screenshot shows the APE Evaluation form for Location SilverFlag:AP Main:AD18. The form is divided into several sections:

- Evaluations:** 26 Silver Flag Structural (8/24/2026), Evaluation Manager...
- Evaluation climate:** USA-Florida, Fort Myers Page Field Airport
- Layer Model:** New, Import, Copy, Rename, Delete, Order by Section ID. A list of models is shown, including SilverFlag:AP Main:AD18 (2 items) and various contingency traffic-PCR models.
- Settings:** Calculate overlays, Analyze Structure As: Rigid, Flexible, Unpaved/Mat, Rigid Failure Criteria For Analysis: Shattered Slab, Load transfer: % Load Transfer 25, Joint Deflection Ratio 0.76, Max Edge Stress 75 %.
- Layers:** A table with columns: Layer Type, Material Type, Thickness (in.), K Value (pci), Effective-k (pci), Flex Strength (psi), Modulus (psi), Poisson's Ratio. The table shows three layers: PCC Partially Bonded Ov., Portland Cement Concrete, and Natural Subgrade.
- Results:** C-17A GLOBEMASTER III. A table with columns: Evaluation Load (lb), Evaluation Passes, AGL (lb), Allowable Passes, ACN, PCN, PCN Strng, ACN/PCN, ACN/PCN Rating, AC Overlay (in.), PCC Nonbonded (in.), PCC Partially Bonded (in.). The results show a Green rating.

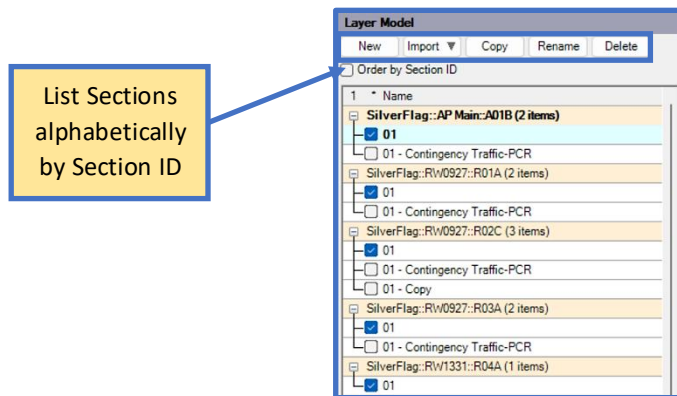
A callout box points to an arrowhead in the Layers table with the text: "Click on an arrowhead to collapse or expand a panel."

14.2.1 Evaluation Manager

Evaluation Manager serves to establish global analysis parameters. To navigate Evaluation Manager; reference Chapter 12 Evaluation Checklist, [Section 12.3 Evaluation Manager](#).

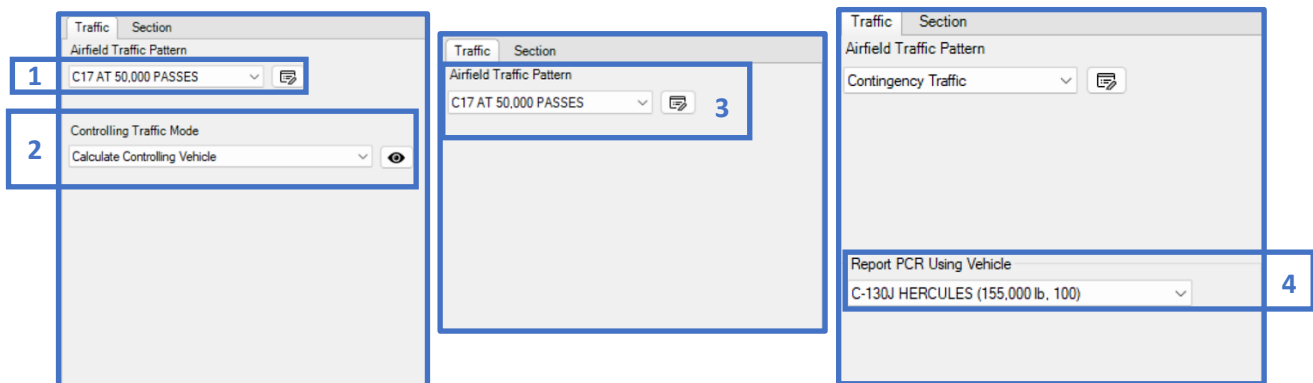
14.2.2 Layer Model

The Layer Model grid populates default pavement structures that may be modified and results for the selected Section of an APE evaluation are displayed in the lower grid. Multiple layer models, each with distinct, user-specified analysis conditions and results, can exist for a given Section of an Evaluation. To create a new model (ad-hoc section), select New. To Import a model from another evaluation, a design, or DCP, select Import. The layer model must be within the current database. To copy an existing model and all the associated analysis conditions and results, select a model then select Copy. Select Rename to edit the default name. To delete a model replicate, select the model, then select Delete.



14.2.3 Traffic tab

1. Traffic patterns defined within Evaluation Manager are available for selection in all evaluations. An existing traffic pattern can be selected from the dropdown or a new traffic pattern can be created by selecting the  icon.
2. If a Mixed Traffic Analysis Type is selected for PCN analysis, the options for Controlling Traffic Mode are: Use Controlling Vehicle from Pattern, Calculate Controlling Vehicle and Choose Controlling Vehicle. Use Controlling Vehicle from Pattern will utilize the loading and equivalent passes of the Controlling Vehicle defined within the Traffic Pattern form. This is based on the Traffic Area, Subgrade Category, and Pavement Type. Calculate Controlling Vehicle will recalculate the loading and equivalent passes of the Controlling Vehicle based on the Traffic Area selected in the Section Properties sub-section, and the Subgrade Category associated with the CBR value of the subgrade within the Layers sub-section. Choose Controlling Vehicle allows you to choose which vehicle in the mix controls.
3. If a Calculation Option for layered elastic using CBR to modulus correlation is selected the Controlling Traffic Mode is hidden. The options for Controlling Traffic Mode are also not displayed when Individual traffic analysis is assigned to a traffic pattern.
4. The Report PCR Using Vehicle field is displayed when the Layered elastic for individual vehicles using CBR to modulus correlation Calculation Option is selected, which allows the option to select which vehicle to use for the reportable PCR.



14.2.4 Section tab

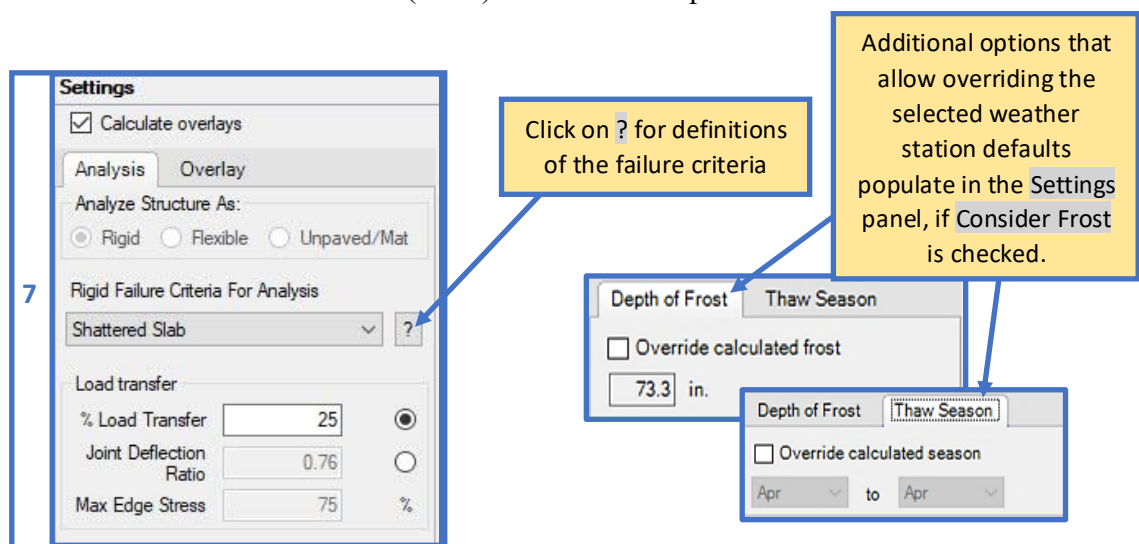
5. The **Inspection/Analysis** tab displays the Pavement Condition Index (PCI), % Load-related Distress, SCI and C_b and C_r, and Evidence of Frost Damage (if applicable) extracted from Define Inventory and Evaluation Manager.
 - In **Inspection Data**, enter the PCI and % Load-related Distress resulting in the SCI, C_b and C_r. A Condition PCI ≤ 40 will activate a load reduction in the Allowable Gross Load (AGL) and an increase in gross weight. The calculated SCI will yield condition factors C_b and C_r that impact the recommended overlay thickness results for rigid pavements.
 - **Analysis Structure Parameters** displays options for **Traffic area**, and **Evidence of Frost Damage**. Use the drop-list to select the appropriate **Traffic area** (Area A, B, C, or D). Check the box for **Evidence of Frost Damage** to enable **Depth of Frost**, **FASSI** or **FAIR** values, **Frost Code**, **Moisture Content**, and **Dry Unit Weight**. These inputs directly impact the **Results** by including results for Frost conditions.
6. The **Inventory Properties** tab displays characteristics of the section, as defined in the **Network Inventory**. *Note: The fields in this tab are only editable for ad-hoc sections.* These characteristics consist of:
 - **Name**
 - **Pavement Use**
 - Airfield or Roadway
 - **Branch Use** (Runway, Taxiway, Roadway, Parking area, etc.)
 - **Pavement Surface**
 - Flexible Surface, Rigid Surface, or Unsurfaced
 - **Surface Type**
 - **Refresh properties from PAVER section** becomes enabled once inventory section properties have changed.

5

6

14.2.5 Settings

7. Settings comprises of Calculate overlays, Analyze Structure as, Rigid Failure Criteria For Analysis (for PCN analysis), Failure SCI (for PCR analysis) and Load transfer (rigid pavement only).
- Check the Calculate overlays box to display overlays in Results for pavements that cannot support the assigned traffic. Select the Overlay tab (PCC pavements only) to display the SCI, Cb, and Cr calculated on the Inspection/Analysis tab. The PCC Overlay Flex strength and Modulus values may be edited in this section.
 - Analyze Structure as displays the pavement surface (Rigid, Flexible, Unpaved/Mat) extracted from Define Inventory.
 - Rigid Failure Criteria For Analysis allows you to set the failure criteria (First Crack, Shattered Slab, Complete Failure).
 - Use the Load transfer (rigid pavement only) options; Percent Load Transfer or Joint Deflection Ratio to change the Max Edge Stress. The defaults are set for a rigid pavement with good load transfer. Increasing the Max Edge Stress results in lower Allowable Gross Loads (AGL) and allowable passes.



14.2.6 Layers

8. The Layers grid populates a default structure for the pavement type. Pavement types available in APE are Rigid, Flexible and Unpaved/Mat.
9. Layers and their coinciding material types can be added or edited using the Add or Change buttons beneath the layer grid. To Add a layer, select the Layer Category and the respective Material Type. The Change layer button becomes enabled when the selected layer can be modified. The Up and Down arrows enable when the selected layer can be moved. The Delete button becomes enabled when a removable layer is selected.

10. For the **Flexible Pavement** displayed below, select the appropriate **Material Type** and enter the **Thickness**, and **CBR** values where required. For PCR analysis, **Modulus**, **Poisson's Ratio** and **Bond** values can be updated, if so desired.
11. For frost analysis, select the appropriate **Frost Code** and edit the **Moisture Content** and **Dry Weight** as needed.
12. Select the appropriate calculation method from **Calculation Options**. See below for descriptions of each calculation type.
 - **APE Beta-Alpha CBR/K for PCN** – This option utilizes California Bearing Ratio (CBR) methods for flexible pavements and subgrade modulus of reaction (k-value) methods for rigid pavements. Traffic is evaluated as individual, mixed, or hybrid based on the parameters configured in the traffic module. This calculation option is used to calculate Pavement Classification Number (PCN) values.
 - **Layered Elastic for PCR using CBR to Modulus Correlation** – This option allows users to input CBR values, which are then correlated to elastic modulus. The analysis combines the correlated modulus values, layered elastic theory, and Cumulative Damage Factor (CDF) methodology to determine allowable aircraft gross loads and allowable passes across the entire traffic mix. This calculation option is used to calculate Pavement Classification Rating (PCR) values
 - **Layered Elastic for Individual Vehicles using CBR to Modulus Correlation** - This option allows users to input CBR values, which are then correlated to elastic modulus. The analysis combines the correlated modulus values, layered elastic theory, and Cumulative Damage Factor (CDF) methodology to determine allowable aircraft gross loads and allowable passes. In this option, CDF is computed for only a single vehicle. This calculation option is used for generating 14-group tables or single-vehicle evaluations (e.g., displaying the PCR for a C-17 at 50,000 passes).
13. After **Run Analysis**, the **FASSI** (frost analysis only), **Allowable Gross Load**, **Allowable Passes** (for PCN analysis) are displayed for each layer and the **Controlling Layer** is flagged.
14. Select **Show Details** to view the standard pavement structure. Select a layer in the **Actual Pavement Structure** grid to view the standard pavement structure above the selected layer(s). This option is only available for flexible structures and PCN analysis.

Layers

#	Layer Type	Material Type	Thickness (in.)	CBR (%)	Modulus (psi)	Poisson's Ratio	Bond
8	Asphalt Concrete	Asphalt Cement	0.00		200,000	0.35	Fully Bonded
	Base	Unbound Aggregate	0.00		0	0.35	Fully Bonded
	Natural Subgrade	Cohesionless Cut	240.00		0	0.40	Fully Bonded

+ Add
 ▲ Change
 ▼
✕ Delete

Show Details
14

View Coverages
Comments
Damage

Calculation Options
12

Run Analysis
13

Frost Code	Moisture Content	Dry Weight (lb/ft³)	#
NFS	0	140	11
NFS	5	135	
F3F4	10	120	

15. Select the **Comments** button to add notes on the analysis. A green checkmark is displayed if a comment has been previously added.
16. **View Coverages** launches a form that displays the pass-to-coverage ratios based on the assigned traffic.
17. Select **Damage** to view cumulative damage data.

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	FAIR	Modulus (psi)	Poisson's Ratio	Bond	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Controlling Layer (AGL)	Controlling Layer (AP)
Asphalt Concrete	Asphalt Cement	6.00			300,000	0.35	Fully Bonded	NFS	0	140	☐	☐
Base	Unbound Aggregate	8.00	80.0		60,286	0.35	Fully Bonded	NFS	5	135	☐	☐
Natural Subgrade	Cohesionless Cut	226.00	10.0	3.5	15,000	0.40	Fully Bonded	F3F4	10	120	☒	☒

Add

Change

Delete

Show Details

Using layered elastic for PCR with CBR to modulus correlation

View Coverages

Comments

Damage

Calculation Options

Run Analysis

13

16

15

17

18. For a **Rigid Pavement** select the appropriate **Material Type** and enter the layer **Thickness**, and **K-Value** (for PCN analysis) where required. The **Effective K** is calculated or can also be entered if known. Edit the **Flexural Strength** (concrete), **Modulus** (concrete and stabilized base/stabilized subbase), **Poisson's Ratio**, and **Bond** values as needed.
19. For frost analysis, select the appropriate **Frost Code** and edit the **Moisture Content** and **Dry Weight** as needed.
20. Select the appropriate calculation option. See Step 12 on the previous page for descriptions of each calculation method.
21. After **Run Analysis**, the **FAIR** (frost analysis only), **Allowable Gross Load**, **Allowable Passes** are displayed for each layer.

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	FAIR (pci)	Flex Strength (psi)	Modulus (psi)	Poisson's Ratio	Bond	Frost Code	Moisture Content	Dry Weight (lb/ft³)	
Portland Cement Concrete	Portland Cement	0.00			0	700	4,000,000	0.15	Partially Bonded	NFS	0	145
Base	Unbound Aggregate	0.00			0		61,000	0.35	Fully Bonded	NFS	5	135
Natural Subgrade	Cohesionless Cut	240.00			0		9,000	0.40	Fully Bonded	F3F4	10	120

Add

Change

Delete

Show Layer Details

Using layered elastic for PCR with CBR to modulus correlation

View Coverages

Comments

Damage

Calculation Options

Run Analysis

18

19

20

21

22. Select **Show Layer Details** to display the **Equivalent PCC Thickness** and **Weighted PCC Flex Strength** for rigid structures.

Layers													
Layer Type	Material Type	Thickness (in.)	CBR (%)	FAIR (pci)	Flex Strength (psi)	Modulus (psi)	Poisson's Ratio	Bond	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Equivalent PCC Thickness (in.)	Weighted PCC Flex Strength (psi)
► Portland Cement Concrete	Portland Cement	8.00		0	700	4,000,000	0.15	Partially Bond...	NFS	0	145	8.00	700
Base	Unbound Aggregate	10.00	60.0	0		49,731	0.35	Fully Bonded	NFS	5	135		
Natural Subgrade	Cohesionless Cut	222.00	8.0	60.6		12,000	0.40	Fully Bonded	F3F4	10	120		

22

Using layered elastic for PCR with CBR to modulus correlation

23. For **Unsurfaced Pavements** select the appropriate **Material Type** and enter the **Thickness** and **CBR** where required.

Layers				
Layer Type	Material Type	Thickness (in.)	CBR (%)	
Unsurfaced	Unbound Aggregate	0.00		
Subbase	Unbound Aggregate	0.00	20.0	
► Natural Subgrade	Cohesionless Cut			

23

24. After **Run Analysis**, the **Allowable Gross Load** and **Allowable Passes** are displayed for each layer and the **Controlling Layer** is flagged.

Layers					24		
Layer Type	Material Type	Thickness (in.)	CBR (%)		Controlling Layer	Allowable Gross Load	Allowable Passes
► Unsurfaced	Unbound Aggregate	12	80.0		☐	823667	2244266
Subbase	Unbound Aggregate	6	20.0		☐	696230	98318
Natural Subgrade	Cohesionless Cut		8.0		☒	486497	10058

25. For **Mat Pavements** select the appropriate **Material Type** and enter the **Thickness** and **CBR** where required.

Layer Type	Material Type	Thickness (in.)	CBR (%)	
Aluminum Mat	Medium Mat			
Subbase	Unbound Aggregate	18.00	56.0	
► Natural Subgrade	Cohesionless Cut		10.0	

25

26. After **Run Analysis**, the **Allowable Gross Load** and **Allowable Passes** are displayed for each layer and the **Controlling Layer** gets flagged.

14.2.7 Results

27. Once all evaluation parameters are defined, select **Run Analysis** to execute the evaluation analysis. View the analysis results in the **Results** grid.

Results for a Flexible pavement frost analysis; PCR analysis

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
C-130J HERCULES	Normal (Aug-Apr)	175,000	75	61,374		1	347	122	2.8	Red
C-130J HERCULES	Thaw-Weakened (M...	175,000	25	61,374		1	404	132	3.1	Red
C-130J HERCULES	Normal (Aug-Apr)	155,000	75	61,374		1	307	122	2.5	Red
C-130J HERCULES	Thaw-Weakened (M...	155,000	25	61,374		1	352	132	2.7	Red
C-130J HERCULES	Normal (Aug-Apr)	135,000	75	61,374		1	267	122	2.2	Red
C-130J HERCULES	Thaw-Weakened (M...	135,000	25	61,374		1	302	132	2.3	Red
C-17A GLOBEMASTER III	Normal (Aug-Apr)	585,000	37,500	205,165		28	433	134	3.2	Red
C-17A GLOBEMASTER III	Thaw-Weakened (M...	585,000	12,500	205,165		9	704	154	4.6	Red
C-17A GLOBEMASTER III	Normal (Aug-Apr)	500,000	75	205,165		1	357	134	2.7	Red
C-17A GLOBEMASTER III	Thaw-Weakened (M...	500,000	25	205,165		1	538	154	3.5	Red
C-17A GLOBEMASTER III	Normal (Aug-Apr)	450,000	75	205,165		1	315	134	2.4	Red
C-17A GLOBEMASTER III	Thaw-Weakened (M...	450,000	25	205,165		1	454	154	2.9	Red
C-5A/B GALAXY	Normal (Aug-Apr)	840,000	75	294,596		1	276	89	3.1	Red
C-5A/B GALAXY	Thaw-Weakened (M...	840,000	25	294,596		1	453	104	4.4	Red
E-3 SENTRY AWAC	Normal (Aug-Apr)	325,000	75	113,981		1	391	122	3.2	Red
E-3 SENTRY AWAC	Thaw-Weakened (M...	325,000	25	113,981		1	613	134	4.6	Red
F-15D EAGLE	Normal (Aug-Apr)	68,000	75	23,848		1	283	99	2.9	Red
F-15D EAGLE	Thaw-Weakened (M...	68,000	25	23,848		1	275	96	2.9	Red
KC-10A REFUELER	Normal (Aug-Apr)	590,000	75	206,919		1	536	178 F/B/W/O	3.0	Red
KC-10A REFUELER	Thaw-Weakened (M...	590,000	25	206,919		1	773	188 F/D/W/O	4.1	Red
KC-135R/T STRATOTANK...	Normal (Aug-Apr)	322,500	75	113,104		1	363	117	3.1	Red
KC-135R/T STRATOTANK...	Thaw-Weakened (M...	322,500	25	113,104		1	556	129	4.3	Red

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
C-17A GLOBEMASTER III	Normal (Aug-Apr)	585,000	37,500	286,267		175	621	233 233/R/C/W/O	2.7	Red
C-17A GLOBEMASTER III	Thaw-Weakened (M...	585,000	12,500	286,267		58	731	254 254/R/D/W/O	2.9	Red

Results for a rigid PCR pavement analysis; single aircraft

Results for an Unsurfaced pavement analysis; single aircraft

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes
C-17A GLOBEMASTER III		585,000	13,801	459,492	3,769

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes
C-17A GLOBEMASTER III		585,000	13,801	512,320	8,166

Results for a Mat pavement analysis; single aircraft

28. When **Respond to selections** is turned on, a variety of selectors can be used to change focus of the section in an evaluation. The **Evaluation checklist** and each of the **Selectors** can be used to switch sections within the APE form. If the option is also turned on in LEEP, both forms will simultaneously respond to the section selection made with a selector.
29. Select **Save Layout** to save panel adjustments made to the form.
30. **View Coverages** launches a form which displays vehicle pass-to-coverage ratios.
31. Select **Reports** to access the predefined Evaluation reports. *Note: PCASE reports use Excel templates without any classification markings based on the assumption that all data is unclassified and publicly releasable. If the information in the individual database is Controlled Unclassified Information (CUI), properly mark any reports generated by PCASE at the appropriate classification level. Add a header and footer with the appropriate classification markings.*
32. If there is DCP data associated with the selected section, a label will populate within the APE form to inform you. Select **Import > from DCP** to transport the layer model into APE.
33. Select the **Close** button to exit APE.

The screenshot displays the APE Evaluation software interface for 'Location SilverFlag-AP Main:A01B'. The interface includes several panels and a main results table.

Top Panel: Shows 'Evaluations' with a dropdown for '26 Silver Flag Structural (8/24/2026)' and 'Evaluation Manager...'. The 'Evaluation climate' is set to 'USA-Florida, Fort Myers Page Field Airport'.

Left Panel (Layer Model): Contains a tree view of layers. A label 'There is DCP data for the current section' is visible. The tree includes 'SilverFlag-AP Main:A01B (2 items)' and '01 - Contingency Traffic-PCR'.

Middle Panel (Settings): Includes 'Calculate overlays' (Analysis, Overlay), 'Failure SCI' (0), 'Load transfer' (% Load Transfer: 25, Joint Deflection Ratio: 0.75), and 'Max Edge Stress' (75 %).

Right Panel (Layers): A table showing layer details:

Layer Type	Material Type	Thickness (in.)	CBR (%)	Flex Strength (psi)	Modulus (psi)	Poisson's Ratio	Bond	Equivalent PCC Thickness (in.)	Weighted PCC Flex Strength (psi)
PCC Partially Bonded Ov	Portland Cement	8.00		700	5,000,000	0.15	Partially Bonded		
Portland Cement Concrete	Portland Cement	10.00		700	5,000,000	0.15	Partially Bonded	13.24	700
Natural Subgrade	Cohesionless Cut	222.00	15.1		19,726	0.40	Fully Bonded		

Bottom Panel (Results): A table showing vehicle evaluation results:

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)	PCC Nonbonded (in.)	PCC Partially Bonded (in.)	PCC Fully Bonded (in.)
C-130J HERCULES	175,000	100	148,178	21	373	306		1.2	Amber	7.3	10.1	7.7	2.6
C-130J HERCULES	155,000	100	148,178	21	323	306		1.1	Green	7.3	10.1	7.7	2.6
C-130J HERCULES	135,000	100	148,178	21	275	306		0.9	Green	7.3	10.1	7.7	2.6
C-17A GLOBEMASTER III	585,000	50,000	495,339	10,598	547	434		1.3	Amber	7.3	10.1	7.7	2.6
C-17A GLOBEMASTER III	500,000	100	495,339	21	440	434		1.0	Green	7.3	10.1	7.7	2.6
C-17A GLOBEMASTER III	450,000	100	495,339	21	383	434		0.9	Green	7.3	10.1	7.7	2.6
C-5A/B GALAXY	840,000	100	711,256	21	414	314		1.3	Amber	7.3	10.1	7.7	2.6
E-3 SENTRY AWAC	325,000	100	275,188	21	494	387		1.3	Amber	7.3	10.1	7.7	2.6
F-15D EAGLE	68,000	100	57,578	21	296	251		1.2	Amber	7.3	10.1	7.7	2.6
KC-10A REFUELER	590,000	100	499,572	21	667	523	523/R/B/W/O	1.3	Amber	7.3	10.1	7.7	2.6
KC-135R/T STRATOTANK	322,500	100	273,071	21	439	342		1.3	Amber	7.3	10.1	7.7	2.6
MV-22 OSPREY	60,500	100	51,227	21	127	103		1.2	Amber	7.3	10.1	7.7	2.6

Bottom Right Panel: Includes buttons for 'View Coverages', 'View F Factors', 'Comments', 'Damage', 'Calculation Options', and 'Run Analysis'. A '30' label is present.

Bottom Left Panel: Includes a 'Traffic' section and a 'Section' dropdown set to 'Contingency Traffic'. A '29' label is present.

Bottom Center Panel: Includes a '31' label and a 'Reports' button.

Bottom Right Panel: Includes a '33' label and a 'Close' button.

14.3 APE Examples

14.3.1 Evaluate pavements by manually inputting layer strength values

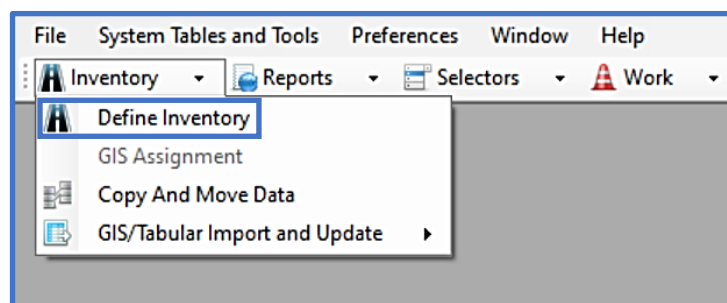
Evaluate the pavements described in Table 1 and 2.

Table 1.					
Grand Forks AFB, ND (Service – Air Force)					
Taxiway A, Section T01A					
Surface – excellent condition (PCI=100)					
Traffic - 14-Group Standard Pattern					
Material Properties					
Layer Type / Classification	Thickness in. (mm)	CBR	Frost Code	% Moisture	Dry Unit Weight pcf (kg/m ³)
Asphalt Concrete	5 (127)	--	NFS	0	145 (2,323)
Unbound Crushed Stone Base	9 (229)	100	NFS	5	135 (3,429)
Unbound Aggregate Subbase	12 (305)	30	NFS	5	135 (3,429)
Clay loam (cohesive cut)	--	13	F4	20	110 (2,794)

Grand Forks AFB, ND; Taxiway A, Section T01A

Step 1. Define the Inventory

- Use the Inventory pulldown and select Define Inventory



- On the Inventory form, select the **Network** tab
- Select **New**
- Type in the **Network ID**, **Network Name**, and **Comments** (optional)

The screenshot shows the 'GFAFB' window with the 'Network' tab selected. The 'Network ID' field contains 'GFAFB', the 'Network Name' field contains 'Grand Forks AFB, ND', and the 'Comments' field is empty. The 'User Defined Fields' section is on the right. At the bottom, the 'You are editing:' section has 'Current Values' selected, and the 'New' button is highlighted.

- On the Inventory form, select the **Branch** tab
- Select **New**
- Type in the **Branch ID**, **Branch Name**, and use the pulldown to select the **Branch Use**
- Select **OK**

The screenshot shows the 'GFAFB' window with the 'Branch' tab selected. A 'New Branch' dialog box is open, showing 'Branch ID: * TWA', 'Branch Name: * Taxiway A', and 'Branch Use: * TAXIWAY'. The 'PAVER Mandatory field' is also indicated. The 'OK' button is highlighted. In the background, the 'New' button in the 'You are editing:' section is also highlighted.

- On the Inventory form, select the **Section** tab
- Select **New**
- Type in the **Section ID**, **Length**, and **Width** (required)
- Type in **From** and **To** (optional)
- Use the pulldown to select the **Constructed date**, **Rank**, and **Surface Type** (required)
- Select **OK**
- Close the inventory form

The screenshot shows the 'New Section' dialog box with the following fields and values:

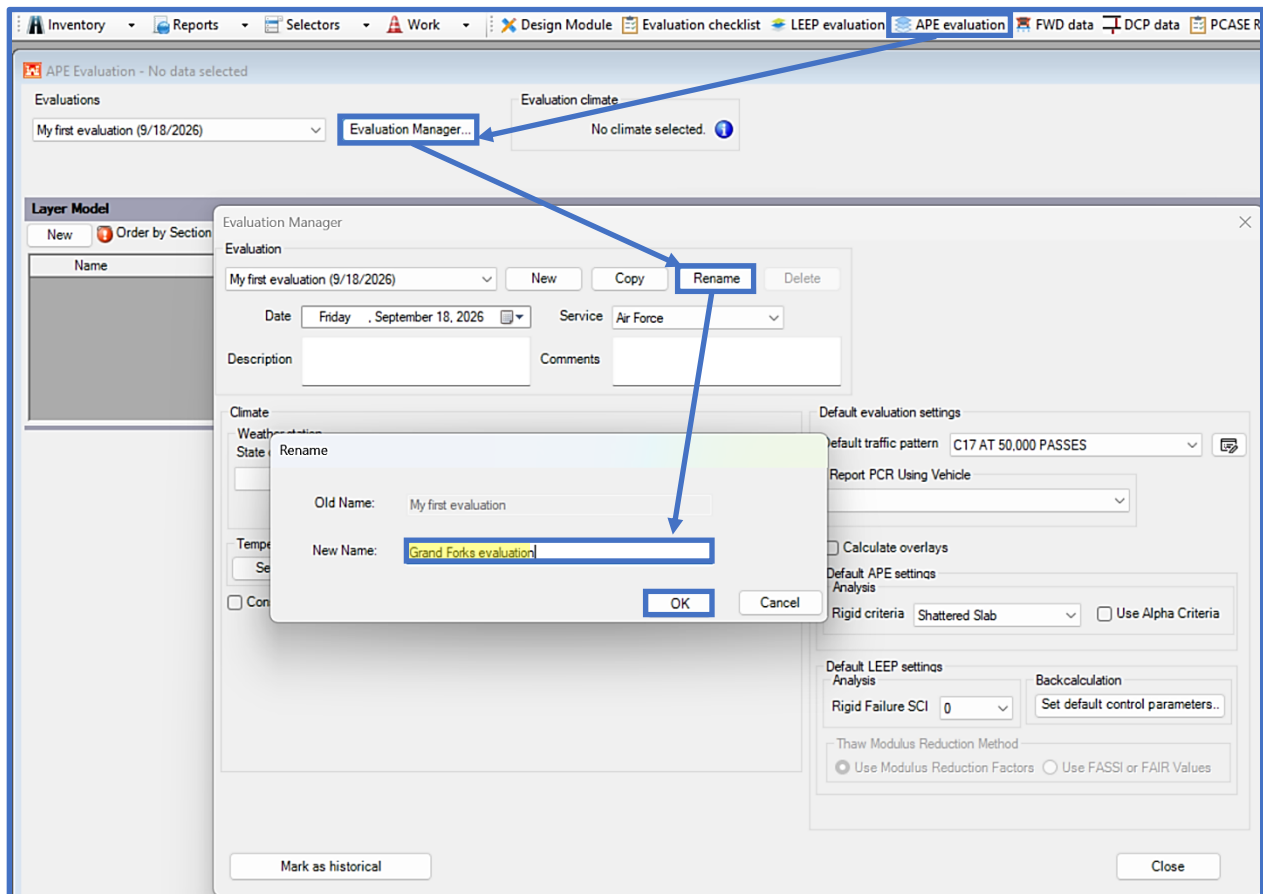
Field	Value
Section ID	T01A
From	
To	
Constructed	9/18/2026
Length	1 Ft
Width	1 Ft
Rank	P
Surface Type	AC
True Area	1 SqFt

Buttons: OK, Cancel

Main Form: You are editing: ☒ Current Values ☐ Historical Inspection Values

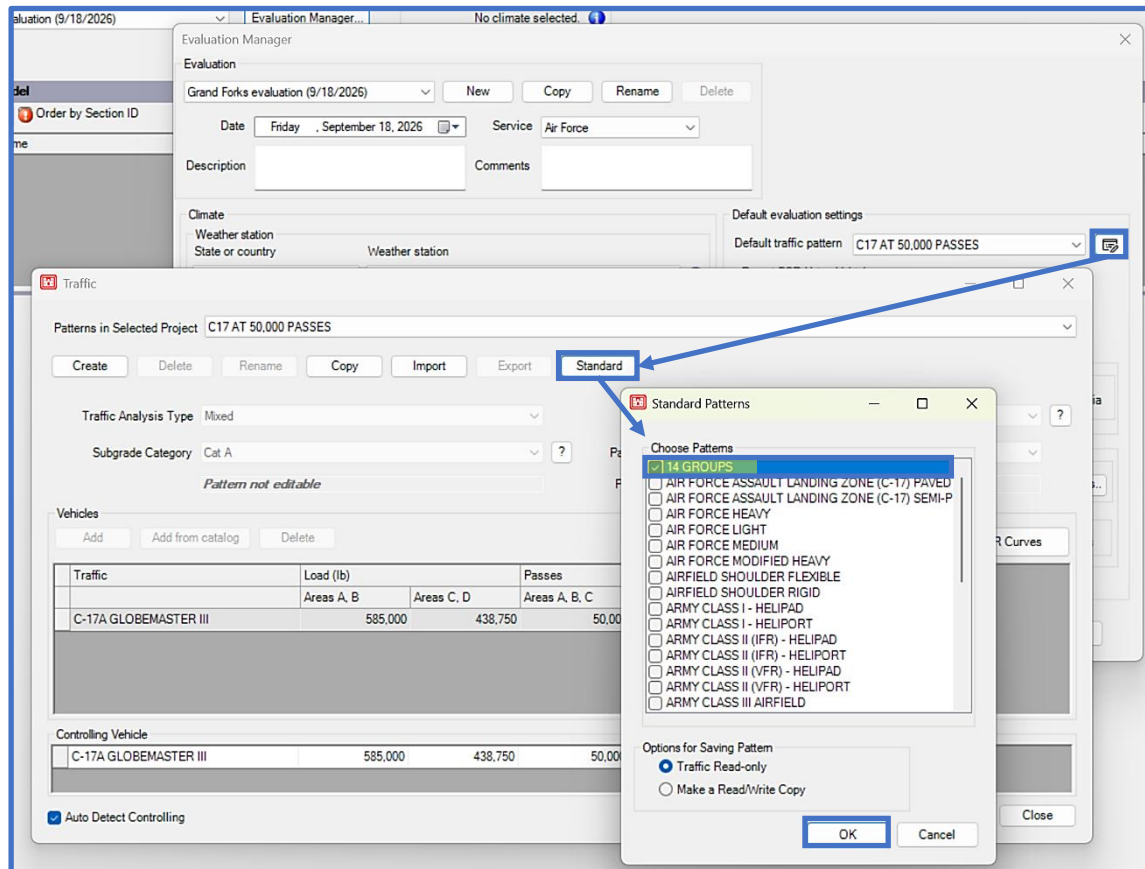
Step 2. Set up the Evaluation

- Select **APE evaluation**
- Click **OK** on the default evaluation confirmation form
- On the APE evaluation form; select **Evaluation Manager**
- On the **Evaluation Manager** form; select **Rename**
- Name the evaluation “Grand Forks evaluation”
- Click **OK**



- On the Evaluation Manager form:
 - Select **Air Force** for the **Service**
 - Select the state and **Weather Station** in the **Climate** section, as shown below
 - Check the box for **Consider Frost**; the **Freezing Season** will populate based on the **Weather Station** information

- On the Evaluation Manager form, under **Default evaluation settings**; click on the **Default traffic pattern** icon
- On the **Traffic** form; select **Standard**
- On the **Standard Patterns** form; select **14 Groups**
- Select **OK** and close the traffic form



- On the Evaluation Manager form:
 - Under **Default evaluation settings**; check the box for **Calculate overlays**
 - Under **Default APE settings**; ensure the **Rigid criteria** is set to **Shattered Slab**
 - Select **Close** to exit the Evaluation Manager and return to APE evaluation

Default evaluation settings

Default traffic pattern: 14 GROUPS-Copy

Report PCR Using Vehicle: [Dropdown]

☒ Calculate overlays

Default APE settings

Analysis: Rigid criteria: Shattered Slab [Dropdown] ☐ Use Alpha Criteria

Default LEEP settings

Analysis: Rigid Failure SCI: 0 [Dropdown]

Backcalculation: Set default control parameters..

Thaw Modulus Reduction Method: ☒ Use Modulus Reduction Factors ☐ Use FASSI or FAIR Values

Close

Step 3. Analyze the pavement using APE evaluation

- On the APE Evaluation form; select New
- On the Select Section form; select T01A
- Click Ok

APE Evaluation - No data selected

Evaluations: Grand Forks evaluation (9/18/2026) [Dropdown] Evaluation Manager...

Evaluation climate: USA-North Dakota, Grand Forks AF

Layer Model

New [Dropdown] Order by: Section.ID

Select Section

Select a section
Select section(s) to create layer model(s). You can also create ad hoc sections which are not stored in the inventory.

New ad hoc section

PID	APE
GFAFB::TWA:T01A	0

☒ ☐ ☐

Layer model(s) name (Leave blank for default)

Ok Cancel

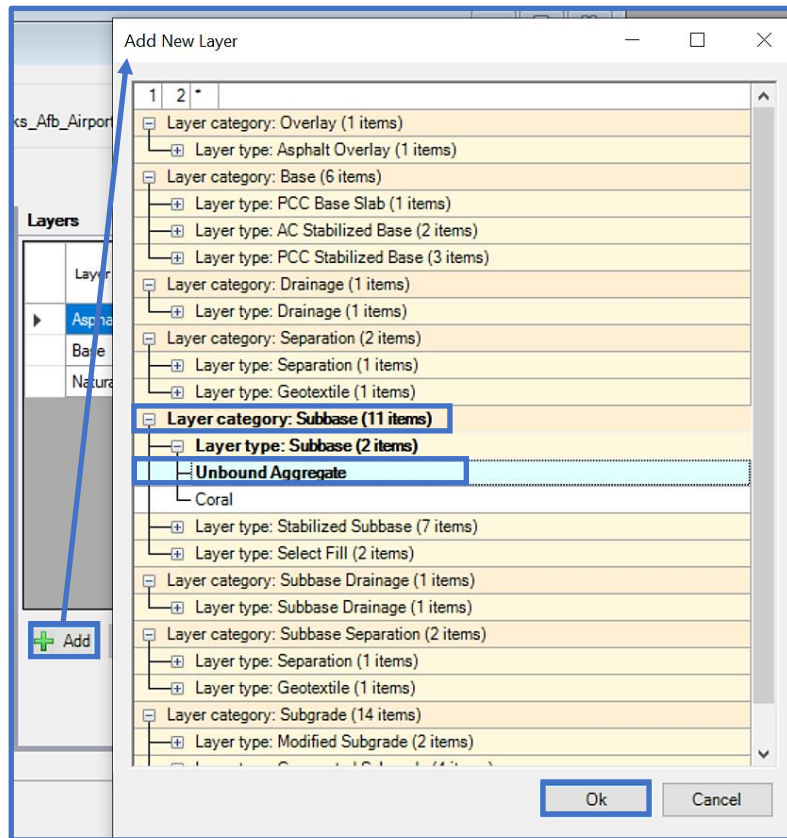
- On the APE evaluation form, under **Layer Model**, the Section populates
- Ensure that the appropriate traffic pattern is selected, if not select the 14 Groups pattern from the drop-list

The screenshot shows the 'Layer Model' form. At the top, there are buttons for 'New', 'Import', 'Copy', 'Rename', and 'Delete'. Below these is a checkbox for 'Order by Section ID'. A table lists items, with 'GFAFB::TWA::T01A (1 items)' and '01' highlighted. At the bottom, the 'Traffic' tab is selected, and the dropdown menu shows 'Airfield Traffic Pattern' and '14 GROUPS-Copy'.

- Select the **Section** tab; all properties shown are correct, no need to edit section properties
- Under **Settings** it defaults to **Calculate overlays** as indicated in Evaluation Manager
- Under the **Analysis** tab
 - **Flexible** is selected, as indicated in Define Inventory
 - The **Depth of Frost** displays based on the selected **Weather Station**

The screenshot shows the 'Layer Model' form with the 'Settings' and 'Analysis' tabs. The 'Settings' tab has 'Calculate overlays' checked. The 'Analysis' tab has 'Flexible' selected under 'Analyze Structure As:'. The 'Depth of Frost' is set to 90 in. The 'Results' section at the bottom says 'The layer model has changed o'.

- On the APE evaluation form, in the **Layers** grid a default pavement section displays; select **Add**, **+ Subbase**, **Unbound Aggregate**
- Select **Ok**



- Change the **Base** layer's **Material Type** to **Unbound Crushed Stone** and the **Natural Subgrade** **Material Type** to **Cohesive Cut**

Layers		
	Layer Type	Material Type
	Asphalt Concrete	Asphalt Cement
▶	Base	Unbound Aggregate
	Subbase	Unbound Aggregate
		Unbound Crushed Stone
	Natural Subgrade	Coral

- Input the **Thicknesses**, **CBR**, **Frost Code**, **Moisture Content**, and **Dry Unit Weight** values for each layer (see Table 1 or reference image below).
- Select **APE** for PCN using hybrid Beta-Alpha criteria in **Calculation Options**
- Select **Run Analysis**

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	FASSI	Frost Code	Moisture Content	Dry Weight (lb/ft³)
Asphalt Concrete	Asphalt Cement	5.00			NFS	0	145
Base	Unbound Crushed Stone	9.00	100.0		NFS	5	135
Subbase	Unbound Aggregate	12.00	30.0		NFS	5	135
Natural Subgrade	Cohesive Cut		13.0		F3F4	20	110

Using APE for PCN with CBR Beta-Alpha criteria

- Under **Results**; select **Group 10** to view results

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	FASSI	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Controlling Layer (AGL)	Allowable Gross Load (lb)	Allowable Passes
Asphalt Concrete	Asphalt Cement	5.00			NFS	0	145			
Base	Unbound Crushed Stone	9.00	100.0		NFS	5	135		1,137,000	99,999,999
Subbase	Unbound Aggregate	12.00	30.0		NFS	5	135		1,069,761	99,999,999
Natural Subgrade	Cohesive Cut		13.0	3.5	F3F4	20	110	☒	1,034,634	99,999,999

Using APE for PCN with CBR Beta-Alpha criteria

Results

Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACN	PCN	PCN String	ACN/PCN	ACN/PCN Rating	AC Overlay (in.)
Normal (Sep-Apr)	585,000	33,333	1,034,634	99,999,999	41	78	78/F/A/W/T	0.5	Green	0.0
Thaw-Weakened (M...	585,000	16,667	297,462	116	70	27	27/F/D/W/T	2.6	Red	
Normal (Sep-Apr)	585,000	10,000	1,137,375	99,999,999	41	86	86/F/A/W/T	0.5	Green	0.0
Thaw-Weakened (M...	585,000	5,000	324,578	116	70	31	31/F/D/W/T	2.3	Red	
Normal (Sep-Apr)	585,000	2,000	1,314,779	99,999,999	41	101	101/F/A/W/T	0.4	Green	0.0
Thaw-Weakened (M...	585,000	1,000	371,738	116	70	38	38/F/D/W/T	1.8	Red	
Normal (Sep-Apr)	585,000	333	1,534,400	99,999,999	41	119	119/F/A/W/T	0.3	Green	0.0
Thaw-Weakened (M...	585,000	167	447,031	116	70	50	50/F/D/W/T	1.4	Amber	

- Open the Evaluation Checklist and select **Evaluation** under **Batch Calculation**
- Select **Additional** > **Calculation Option** > **Calculate PCR**
- Click **Calculated Selected** then after results exist, close the form

Evaluation Checklist

Grand Forks evaluation (9/19/2020) Evaluation Manager... Export Evaluation Data Import Evaluation Data

Sections

Drag column here to group by

Section Name	Ad hoc	Surface type	Use	APE	APE status	LEEP	LEEP Status
GFAFB-TWA-T01A	☐	AC	TAXIWAY	1	has results		no evaluation

Manage Sections in Evaluation

Batch Calculation

Calculate Evaluation Results

Grand Forks evaluation

What to calculate

☐ Assigned
 ☒ Additional
 ☐ Traffic Pattern
 ☒ Calculation Option Calculate PCR

1	Section	Status	Calculate
	APE (1 items)		
	GFAFB-TWA-T01A	No results	☒

- Open the APE evaluation form
- Select the additional model “PCR”
- In the Results grid, scroll down to Group 13
- The Reportable PCR is displayed for both the normal period and thaw-weakened season

Evaluations
Grand Forks evaluation (9/18/2025) Evaluation Manager... Evaluation climate USA-North Dakota, Grand Forks AF

Layer Model
New Copy Rename Delete
Order by Section ID
1 * Name
GFAFB-TWA-T01A (2 items)
01
01-PCR

Traffic Section
Airfield Traffic Pattern
14 GROUPS Copy

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	FASST	Modulus (psi)	Poisson's Ratio	Bond	Frost Code	Moisture Content	Dry Weight (lb/ft³)	Controlling Layer (AGL)	Controlling Layer (AP)
Asphalt Concrete	Asphalt Cement	5.00			200,000	0.35	Fully Bonded	NFS		145	☒	☐
Base	Unbound Crushed St...	9.00	100.0		69,992	0.35	Fully Bonded	NFS		135	☐	☐
Subbase	Unbound Aggregate	12.00	30.0		31,278	0.35	Fully Bonded	NFS		135	☐	☐
Natural Subgrade	Cohesive Cut	214.00	13.0	3.5	17,876	0.40	Fully Bonded	F3F4		110	☐	☒

Using layered elastic for PCR with CBR to modulus correlation
View Coverages Comments Damage Calculation Options Run Analysis

Results

Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating	AC Overlay (in.)
*GROUP12	Normal (Sep-Apr)	775,000	10,000	254,110	1	787	228		3.5	Red	37.6
*GROUP12	Thaw-Weakened (M...	775,000	5,000	254,110	1	1273	247		5.2	Red	37.6
*GROUP12	Normal (Sep-Apr)	775,000	2,000	254,110	1	787	228		3.5	Red	37.6
*GROUP12	Thaw-Weakened (M...	775,000	1,000	254,110	1	1273	247		5.2	Red	37.6
*GROUP12	Normal (Sep-Apr)	775,000	333	254,110	1	787	228		3.5	Red	37.6
*GROUP12	Thaw-Weakened (M...	775,000	167	254,110	1	1273	247		5.2	Red	37.6
*GROUP13	Normal (Sep-Apr)	1,300,727	33,333	426,487	2	934	238	238/F/B/W/O	3.9	Red	37.6
*GROUP13	Thaw-Weakened (M...	1,300,727	16,667	426,487	1	1599	274	274/F/D/W/O	5.8	Red	37.6
*GROUP13	Normal (Sep-Apr)	1,300,727	10,000	426,487	1	934	238		3.9	Red	37.6
*GROUP13	Thaw-Weakened (M...	1,300,727	5,000	426,487	1	1599	274		5.8	Red	37.6
*GROUP13	Normal (Sep-Apr)	1,300,727	2,000	426,487	1	934	238		3.9	Red	37.6
*GROUP13	Thaw-Weakened (M...	1,300,727	1,000	426,487	1	1599	274		5.8	Red	37.6
*GROUP13	Normal (Sep-Apr)	1,300,727	333	426,487	1	934	238		3.9	Red	37.6
*GROUP13	Thaw-Weakened (M...	1,300,727	167	426,487	1	1599	274		5.8	Red	37.6
*GROUP14	Normal (Sep-Apr)	488,000	10,000	160,007	1	706	193		3.7	Red	37.6
*GROUP14	Thaw-Weakened (M...	488,000	5,000	160,007	1	1023	215		4.8	Red	37.6
*GROUP14	Normal (Sep-Apr)	488,000	2,000	160,007	1	706	193		3.7	Red	37.6
*GROUP14	Thaw-Weakened (M...	488,000	1,000	160,007	1	1023	215		4.8	Red	37.6

- Select the Damage button to view cumulative damage factors

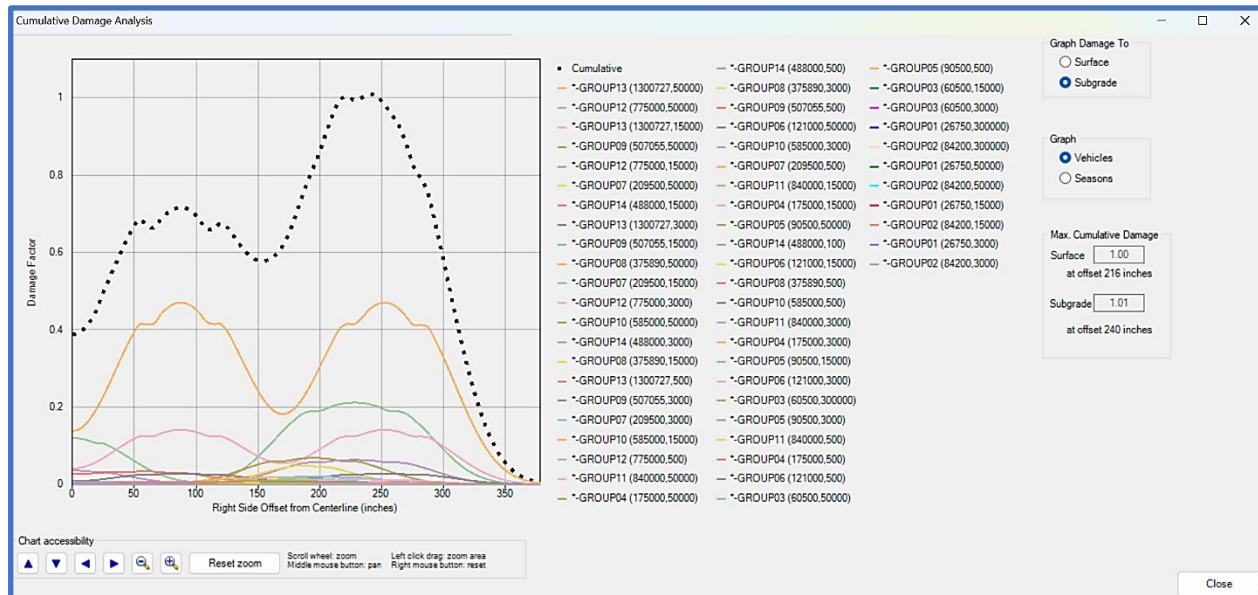


Table 2.					
Grand Forks AFB, ND (Service – Air Force)					
Apron B, Section A02B					
Surface – poor condition (PCI=40; load distress=75%)					
Traffic – 14-Group Standard Pattern					
Layer Type / Classification	Thickness in. (mm)	K Pci (kPa/mm)	Frost Code	% Moisture	Dry Unit Weight pcf (kg/m ³)
Portland Cement Concrete Flex strength = 650 psi (4.48 MPa)	20 (508)	--	NFS	0	145 (2,323)
Sandy Gravel (GW) Base	4 (102)	--	NFS	5	135 (3,429)
Clay loam (cohesive cut)	--	125	F4	20	110 (2,794)

Grand Forks AFB, Apron B, Section A02B

Step 1. Define the Inventory

- On the Inventory form, in the GFAFB Network, select the **Branch** tab
- Select **New**
- Type in the **Branch ID**, **Branch Name**, and use the pulldown to select the **Branch Use**
- Select **OK**

The screenshot displays the 'GFAFB: TWA::T01A' software interface. The 'Branch' tab is active in the background, showing fields for 'Branch ID: TWA', 'Use: TAXIWAY', and 'Sum of Section: 1.00'. Overlaid on this is the 'New Branch' dialog box. In the dialog, 'Branch ID' is set to 'PAB', 'Branch Name' is 'Apron B', and 'Branch Use' is 'APRON'. A note below these fields states '* PAVER Mandatory field'. At the bottom of the dialog are 'Cancel' and 'OK' buttons. The main window also shows a 'You are editing:' section with 'Current' selected and a 'New' button highlighted.

- On the Inventory form, select the **Section** tab
- Select **New**
- Type in the **Section ID**, **Length**, and **Width** (required)
- Type in **From**, **To**, and **Slab Data** (optional)
- Use the pulldown to select the **Constructed date**, **Rank**, and **Surface Type** (required)
- Select **OK** and close the inventory form

Evaluation Manager (Step 2) was accomplished in the previous example (Taxiway A, Section T01A); proceed to Step 3.

Step 3. Analyze the pavement using **APE** evaluation

- On the APE evaluation form; select **New**
- On the **Select Section** form; select section A02B
- Select **Ok**

- On the APE evaluation form, under **Layer Model**; the selected section populates
- Ensure the 14 Groups traffic pattern is selected
- Select the **Section** tab
 - Input the appropriate **PCI** and **% Load-related Distress** (see Table 2)
 - Select **Calculate** to display the resultant **SCI**, **C_b**, and **C_r**
 - All other properties shown are correct, no need for further edits

The screenshot displays the 'Layer Model' software interface. At the top, there are buttons for 'New', 'Import', 'Copy', 'Rename', and 'Delete'. Below these is a checkbox for 'Order by Section ID'. A tree view shows a hierarchy of sections: 'GFAFB::PAB::A02B (1 items)' containing '01', and 'GFAFB::TWA::T01A (2 items)' containing '01' and '01 - PCR'. The '01' item under 'GFAFB::TWA::T01A' is selected. Below the tree view, there are two tabs: 'Traffic' and 'Section'. The 'Section' tab is active, showing 'Inspection/Analysis' and 'Inventory Properties' sub-tabs. Under 'Inspection Data', the 'PCI' is set to 40 and '% Load-related Distress' is set to 75. A 'Calculate' button is highlighted. Below this, the calculated values are displayed: 'SCI' is 55, 'C_b' is 0.72, and 'C_r' is 0.58. Under 'Analysis Structure Parameters', the 'Traffic area' is set to 'Area B' and the 'Evidence of Frost Damage' checkbox is checked. At the bottom, there is a button labeled 'Refresh Properties from PAVER Section'.

- Under **Settings**, **Calculate overlays** is turned on by default as indicated in **Evaluation Manager**
- Under the **Analysis** tab
 - **Rigid** is selected for structure analysis, as indicated in **Define Inventory**
 - The **Depth of Frost** displays
 - Click on the **Thaw Season** tab to view or override the calculated thaw season

Settings

☒ Calculate overlays

Analysis **Overlay**

Analyze Structure As:

☒ Rigid ☐ Flexible ☐ Unpaved/Mat

Failure SCI: ?

Load transfer

% Load Transfer: ☒

Joint Deflection Ratio: ☐

Max Edge Stress: %

Depth of Frost **Thaw Season**

☐ Override calculated frost

in.

- On the APE evaluation form, in the **Layers** grid, a default pavement section displays
- Select **APE for PCN using K** in **Calculation Options**
- Input the **Thickness**, **K**, **Flexural Strength**, **Frost Code** Moisture Content, and **Dry Unit Weight** values for each layer (as shown below or in Table 2)
- Keep the default values for **Modulus** and **Poisson's Ratio**
- Select **Run Analysis**

Layers

Layer Type	Material Type	Thickness (in.)	K Value (pci)	Effective-k (pci)	FAIR (pci)	Flex Strength (psi)	Modulus (psi)	Poisson's Ratio	Frost Code	Moisture Content	Dry Weight (lb/cu ft)
Portland Cement Concrete	Portland Cement	20.00			0	650	4,000,000	0.15	NFS	0	145
Base	Unbound Crushed St...	4.00	0	156	0				NFS	5	135
Natural Subgrade	Cohesive Cut		125		0				F3F4	20	110

Using APE for PCN with K criteria

- Under **Results**; select **Group 10**

Results

	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGI (lb) Includes 25% Load Reduction	Allowable Passes Includes 25% Gross Weight Increase	ACN	PCN	PCN String	ACN/PCN	ACN/PCN Rating	AC Overlay (in.)	PCC Nonbonded (in.)	PCC Partially Bonded (in.)	PCC Fully Bonded (in.)
*GROUP01	Normal (Sep-Apr)	585,000	33,333	697,754	354,685	54	66	66/R/C/W/T	0.8	Green	0.0	0.0	0.0	0.0
*GROUP02	Thaw-Weakened (M...)	585,000	16,667	337,090	2,782	66	31	31/R/D/W/T	2.1	Red				
*GROUP03	Normal (Sep-Apr)	585,000	10,000	791,076	354,685	54	75	75/R/C/W/T	0.7	Green	0.0	0.0	0.0	0.0
*GROUP04	Thaw-Weakened (M...)	585,000	5,000	369,720	2,782	66	36	36/R/D/W/T	1.8	Red				
*GROUP05	Normal (Sep-Apr)	585,000	2,000	922,133	354,685	54	90	90/R/C/W/T	0.6	Green	0.0	0.0	0.0	0.0
*GROUP06	Thaw-Weakened (M...)	585,000	1,000	424,229	2,782	66	43	43/R/D/W/T	1.5	Red				
*GROUP07	Normal (Sep-Apr)	585,000	333	1,138,087	354,685	54	113	113/R/C/W/T	0.5	Green	0.0	0.0	0.0	0.0
*GROUP08	Thaw-Weakened (M...)	585,000	167	506,805	2,782	66	55	55/R/D/W/T	1.2	Amber				

15 FWD data

FWD data provides a dashboard to upload, view, and analyze FWD/HWD data. This interface provides data visualization tools of deflection basin information and parameters which allow you to perform quality control of structural data, and to select basins for backcalculation and subsequent analyses in LEEP evaluation.

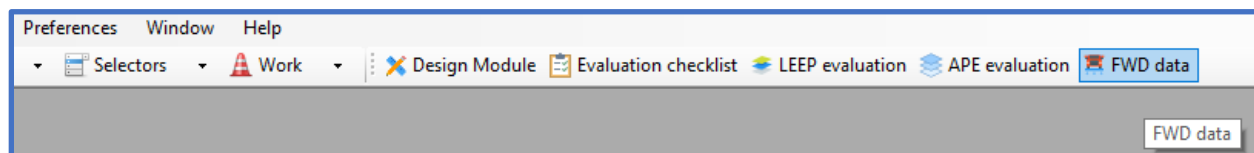
Prior to beginning a new evaluation, ensure that you have opened or created a database to store the evaluation within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference [Chapter 2 File Menu](#).

Prior to using the FWD data form, ensure you have defined an inventory (unless you will be creating sections Ad Hoc); reference [Chapter 7 Inventory](#).

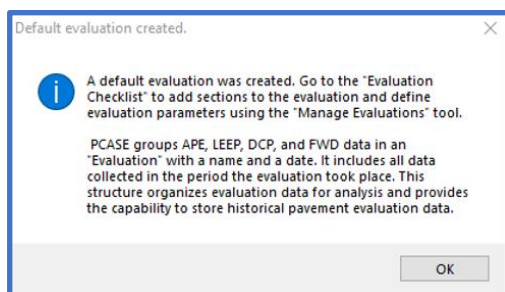
The asset inventory should be initialized prior to using the FWD data form; reference [Chapter 12 Evaluation checklist](#).

15.1 Getting Started

Select FWD data on the PCASE 7 tool bar to open the FWD data tool.



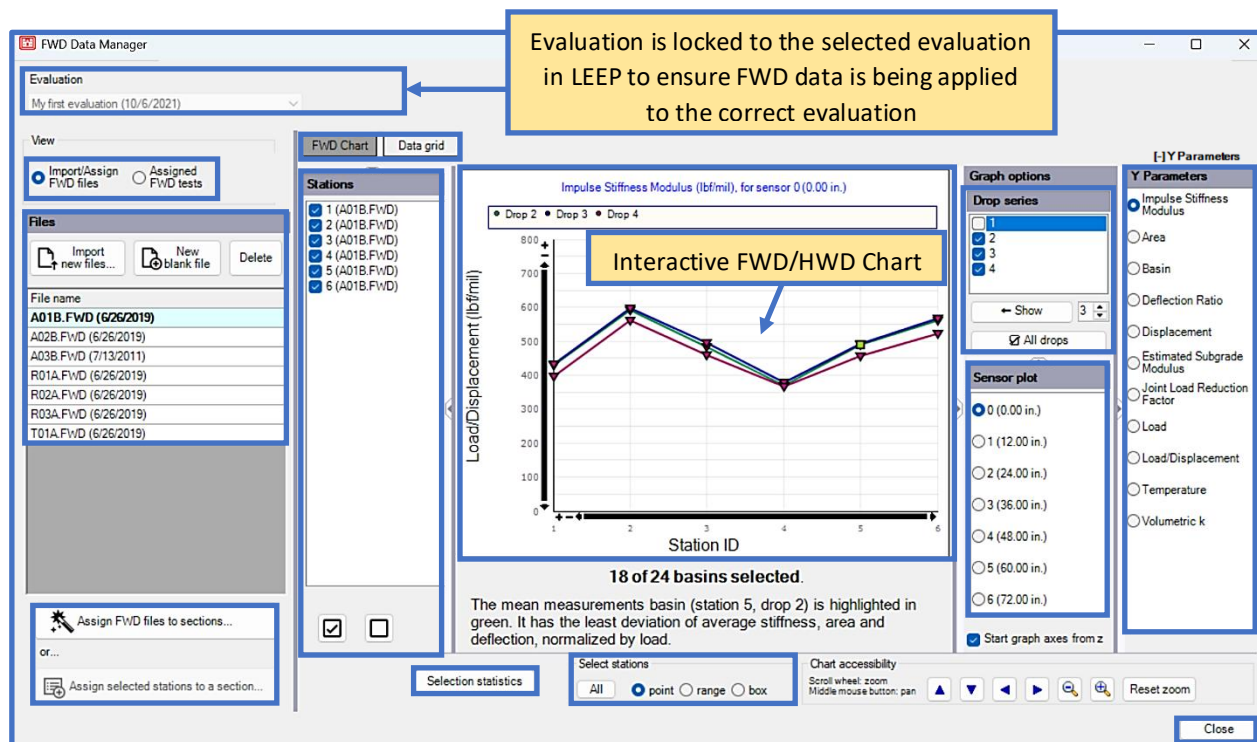
If you have not imported or created an evaluation in the current database, the message below pops up indicating a default evaluation was created. Click **OK** to continue and open the FWD data form.



15.2 FWD data form

The FWD data manager serves as the interface to import/enter deflection basin data, pre-process, and assign FWD/HWD deflection data to inventory sections. Additionally, data visualization features are integrated into the form for viewing the deflection basin parameters (e.g., ISM, etc.), associated section trends, and descriptive statistics. This form is also accessible from within the LEEP evaluation form. The assigned FWD/HWD data assigned to inventory sections are then utilized as part of subsequent pavement analysis within the LEEP evaluation form. To learn how to perform a LEEP analysis, reference [Chapter 13 LEEP evaluation](#).

The FWD data form is displayed below. As part of data processing and performing QC/QA of deflection data, you will perform different operations through the selection of applicable functions provided under the different sub-sections within the form. The primary functions consist of: Import/Assign FWD files, Assign FWD tests, Assign selected stations to a section, FWD Chart, Data grid, Select stations, Drop series selection, Sensor plot, Y-axis Parameters (i.e., Deflection Basin Parameters), and Selection statistics. Select Close to exit the form.



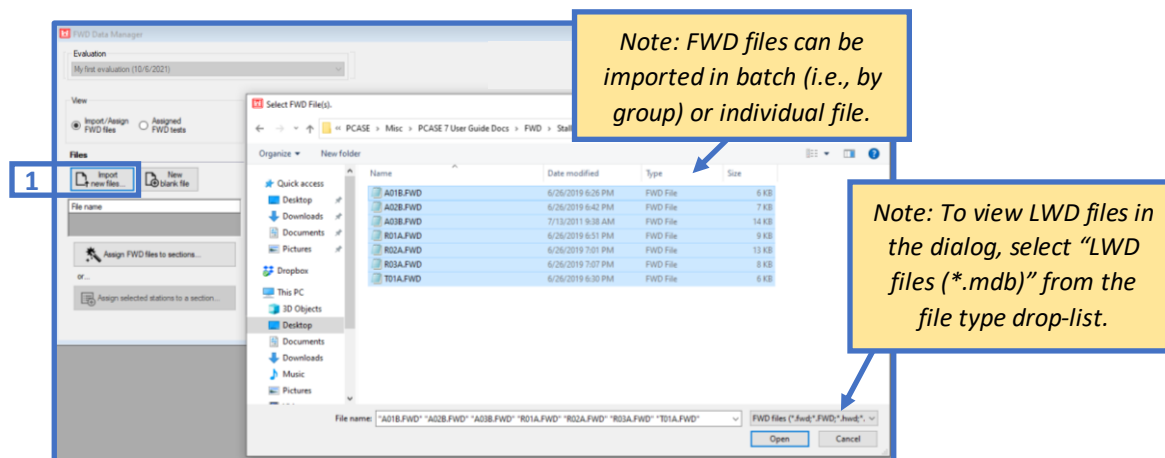
15.2.1 Evaluation Manager

Evaluation Manager serves to establish global analysis parameters. To navigate Evaluation Manager; reference Chapter 12 Evaluation Checklist, [Section 12.3 Evaluation Manager](#).

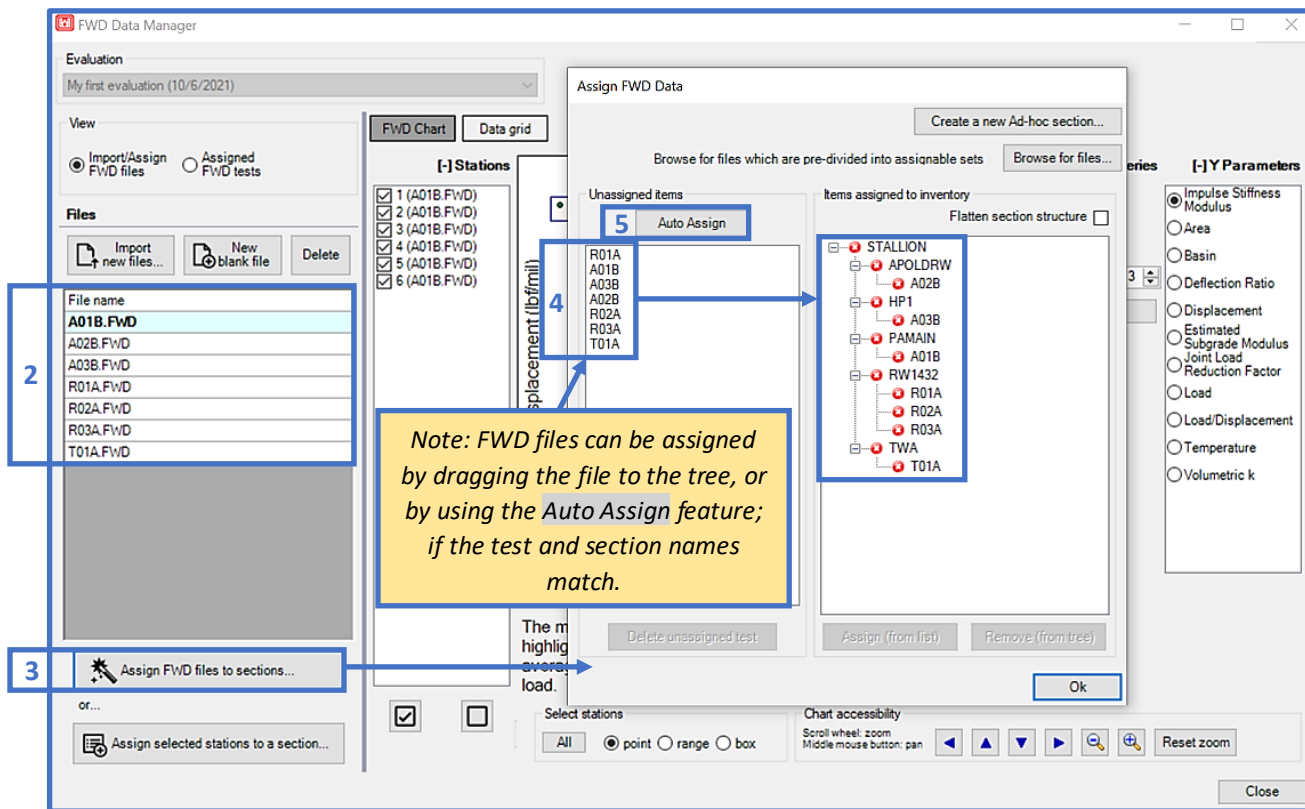
15.2.2 Import, Enter and Assign FWD/HWD Files to Section Inventory

The FWD data form provides different modes for uploading deflection basin data. Deflection basin data can be uploaded through .FWD or .HWD files. Parameters in these data files can also be edited or modified using the FWD Data grid. FWD and HWD data can also be entered manually in the FWD data form itself. Once deflection basin data is uploaded or entered, then you can employ functions within the FWD data form to assign the data to inventory sections. The following demonstrates modes on how to upload and assign FWD and HWD data:

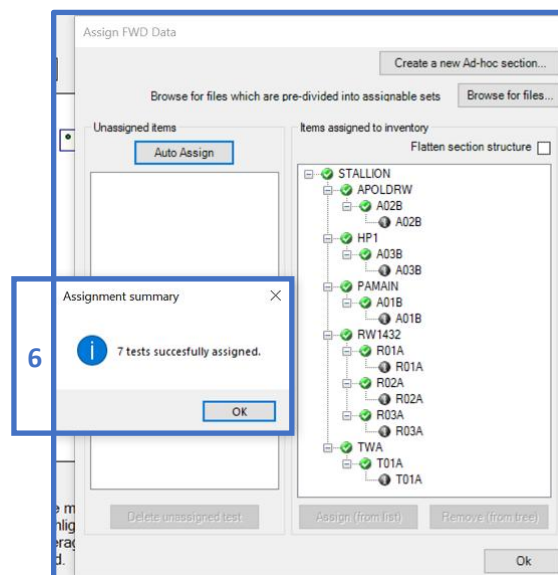
- To import FWD, HWD/KUAB, DAT, JILS, or LWD raw data files in their raw data format, select **Import new files...**. If PCASE 7 does not currently support your .FWD or .HWD data file, then contact: Matthew Bennett, Matthew.D.Bennett@usace.army.mil for further technical support.
 - To manually enter deflection data and associated parameters, select **New blank file**.
 - View imported FWD/HWD or manually entered deflection information in graphical format through the **FWD Chart** feature, or in tabular format through the **Data grid** feature.
1. Select **Import new files...** to choose the FWD/HWD files to import. The FWD/HWD files can be imported in a batch (by selecting multiple files) or individually. Select **Open** to initialize the import.



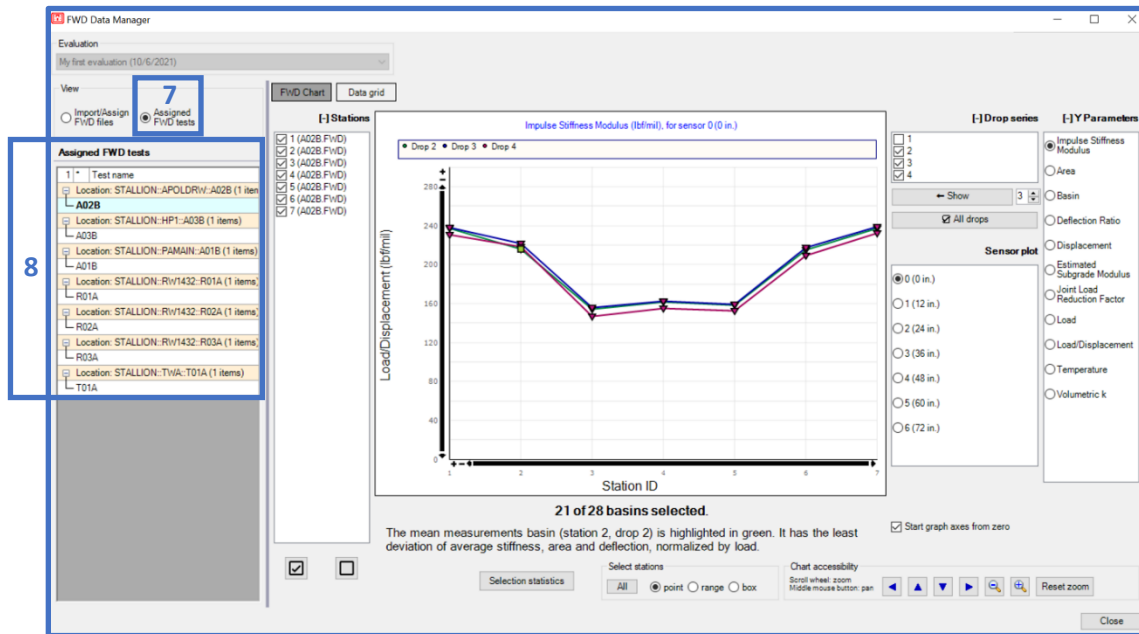
2. The successfully imported FWD/HWD files will be listed by **File name**.
3. Select **Assign FWD files to sections** to assign each imported file to the respective inventory section within the **Assign FWD Data** form.
4. To assign an FWD file to a section, select each individual file then drag it to the associated section in the **Items assigned to inventory** tree.
5. To automate this process, select **Auto Assign**. *Note: The individual FWD/HWD file must have the same file name as the associated inventory section name.*



6. When **Auto Assign** is performed; a confirmation summary will display indicating the quantity of tests successfully assigned. This summary will also provide an indication of errors (if encountered).



7. Select **Assigned FWD tests** to view the FWD/HWD tests assigned to their respective sections.
8. Assigned FWD/HWD items are displayed in the grid. The selected test name is in bold. To select another test, click on an item in the grid and the form will populate with the appropriate test data.



9. Select **Data grid** to switch to the dashboard for viewing/editing FWD/HWD data in tabular format.
10. Select the **Test name** to display the associated FWD/HWD data.
11. Select **Enable editing** to edit test parameters and data.
12. Deflection basin and logged temperature data can also be viewed/edited directly.

Assigned FWD tests

- 1 Test name
- Location: STALLION-APOLDRW-A02B (1 item)
- A02B
- Location: STALLION-HP1-A03B (1 item)
- A03B
- Location: STALLION-PAMAIN-A01B (1 item)
- A01B
- Location: STALLION-RW1432-R01A (1 item)
- R01A
- Location: STALLION-RW1432-R02A (1 item)
- R02A
- Location: STALLION-RW1432-R03A (1 item)
- R03A
- Location: STALLION-TVIA-T01A (1 item)
- T01A

Station and deflection data

Station #	Air temp (°F)	Pave temp (°F)	Surface temp (°F)	Time	Drop #	Load (lbf)	D1 (mils)	D2 (mils)	D3 (mils)	D4 (mils)	D5 (mils)	D6 (mils)	D7 (mils)
1	98	114	108	1838	1	11305	50.19	21.19	6.44	4.11	3.16	2.39	1.89
					2	11480	48.34	21.12	6.58	4.20	3.23	2.45	1.87
					3	11480	48.28	21.12	6.64	4.24	3.22	2.46	1.94
					4	9103	39.54	17.01	5.27	3.37	2.54	1.94	1.54
2	98	114	112	1838	1	11239	61.91	18.48	6.26	3.85	2.89	2.22	1.78
					2	11491	53.30	17.89	6.38	3.94	2.97	2.30	1.86
					3	11590	52.42	18.24	6.49	4.07	3.02	2.31	1.83
					4	9256	42.46	14.84	5.20	3.44	2.42	1.80	1.49
3	99	114	111	1839	1	11886	77.74	18.01	6.82	4.46	3.37	2.63	2.37
					2	12137	78.79	18.60	7.14	4.60	3.47	2.46	2.31
					3	12072	77.63	18.64	7.17	4.57	3.43	2.57	2.29
					4	9497	64.81	15.18	5.72	3.57	2.68	1.85	1.64

13. Select **View raw imported data** to display the raw FWD/HWD data.

View raw imported data

FWD File (A02B.FWD on 6/26/2019 2:00:00 AM)

```

R80 20190626A02B 36F20 70 08012-009 78713 00
60
150 0 305 610 914121915241829 5.91 0.00 12.00 24.00 36.00 48.00 60.00 72.00
C:\StallionAAF2019FWD\ FWD
Stallion AAF
S
S
502302 615 1 7
7.915.0 3.510.0 3.020.0 3.010.0
Ld 7085 1.000 63.7
D1 8727 0.994 0.993
D2 8729 0.995 0.974
D3 8731 0.993 0.987
D4 8732 0.992 0.999
D5 8733 0.990 0.987
D6 8734 0.991 0.999
D7 8735 0.995 0.993
D* NO 1.000 1.000
D* NO 1.000 1.000
D* NO 1.000 1.000
Administrator
11 5 1110 1 1
5.2.0 2.2.0
*
DxCy PxNnnnS 000+0.0 000+0.0 St
Cy P Nnnn
000+0.0 000+0.0 St
300 0 0 0 0 0 0 0 0 11.81 0.00 0.00 0.00 0.00 0.00 0.00
7 28 2350 17202
2221.....
2221.....
****

```

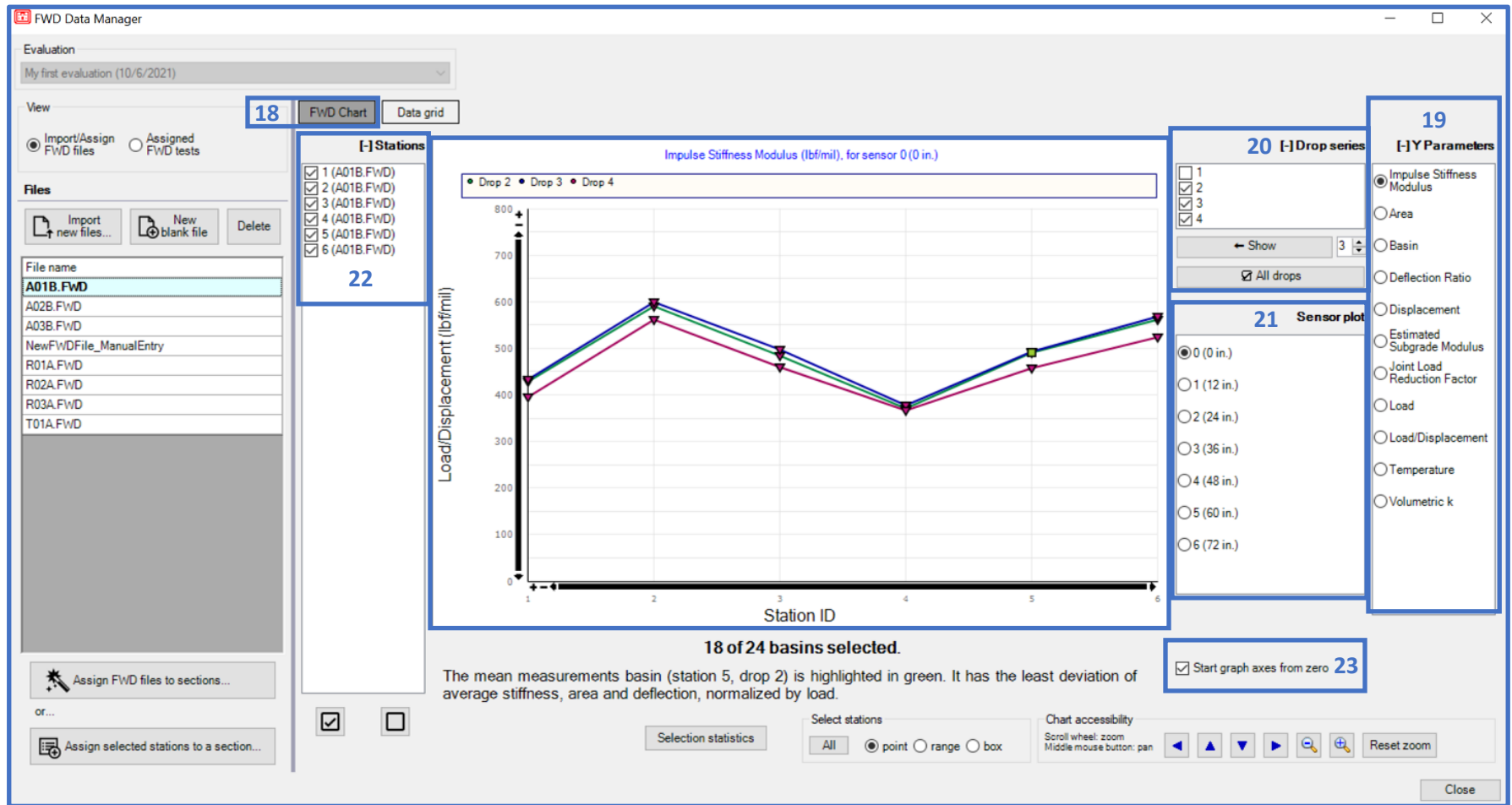
14. To manually enter FWD/HWD data, select the radio button **Import/Assign FWD files**.
15. Select **New blank file**, then input the item/file **Name** and the total **#** of sensors.
16. Select **Enable Editing** to enable the data grid fields for parameter/data entry.
17. Input data for **Load plate and sensors** and **Station and deflection data** values.

15.2.3 Interacting with the FWD/HWD Chart

The FWD data form provides an interactive dashboard to view and process individual FWD/HWD station data points. The form functions allow you to practice engineering judgement – coupled with provided descriptive statistical analysis tools and deflection basin parameter data visualization charts – to process FWD/HWD data points and perform QC/QA of collected data.

18. Select **FWD Chart** to view the FWD/HWD data assigned to each inventory section.
The data visualization chart is interactive; pan the cursor over each data point to display the data label. The FWD Chart can be refreshed by toggling through each **File name**.
19. Click on the **Y Parameters** radio button of choice to display: **Impulse Stiffness Modulus (ISM)**, **Area**, **Basin**, **Deflection Ratio**, **Displacement**, **Estimated Subgrade Modulus**, **Joint Load Reduction Factor**, **Load**, **Load/Displacement**, **Temperature**, or **Volumetric K**.

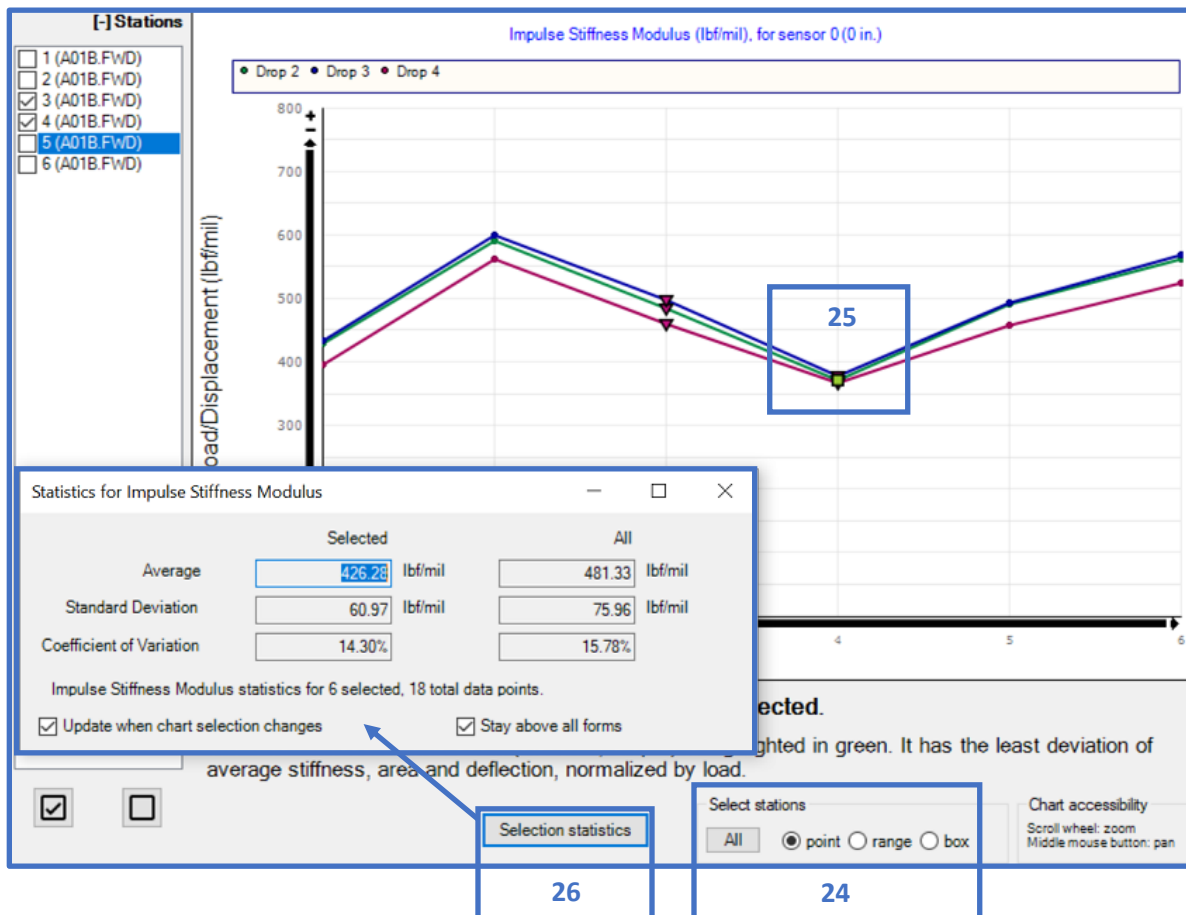
20. The chart can be filtered by selected **Drop series**. Select each check box to view/disable the drop series for data visualization and subsequent data selection for section assignment and/or statistics. *Note: Drop 1 is unchecked by default.*
21. The **Sensor plot** selection is enabled for: **Impulse Stiffness Modulus**, **Deflection Ratio**, **Displacement**, **Joint Load Reduction Factor**, **Load/Displacement**, and **Temperature**.
22. The chart can be filtered by selected **Stations**. Select each check box to view/disable **Stations** for data visualization and subsequent data selection for section assignment and/or statistics.
23. The data visualization y-axis chart will resize and apply a y-axis minimum value when **Start graph axes from zero** is disabled.



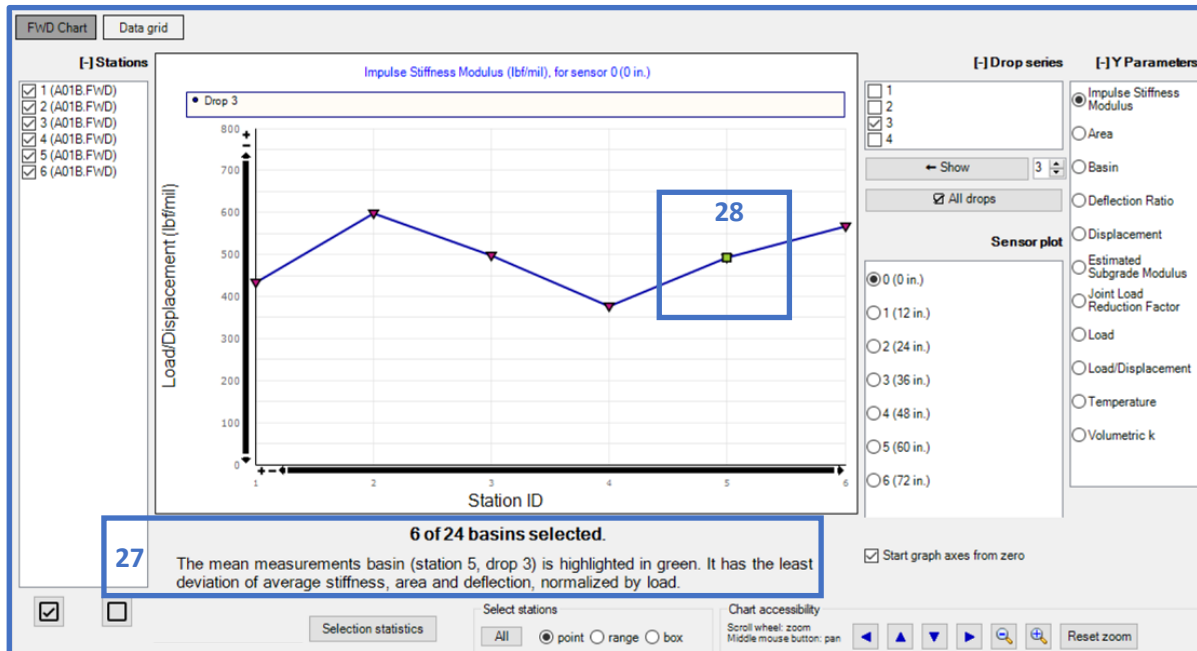
15.2.4 Selecting FWD/HWD Data Points and Viewing Representative Basin

The FWD Chart is interactive; enabling users to view the Representative Basin, and descriptive statistics based on user-defined FWD/HWD drop series, and individual station datapoints.

24. Use the **Select stations** options to select: **All** data points, **point** for individual selection, a **range** of points within established bounds, or **box** for points within the user-established “box” for inclusion within subsequent descriptive statistics calculations of the parameter of interest.
25. The chart selection method is initialized by using the mouse to select/exclude individual points and/or establish the range bounds (**range** or **box**).
26. Select **Selection Statistics** to display the descriptive statistics for the selected data points. The calculated statistics are also dependent on the selected **Stations**, **Drop series**, and **Sensor plot**.



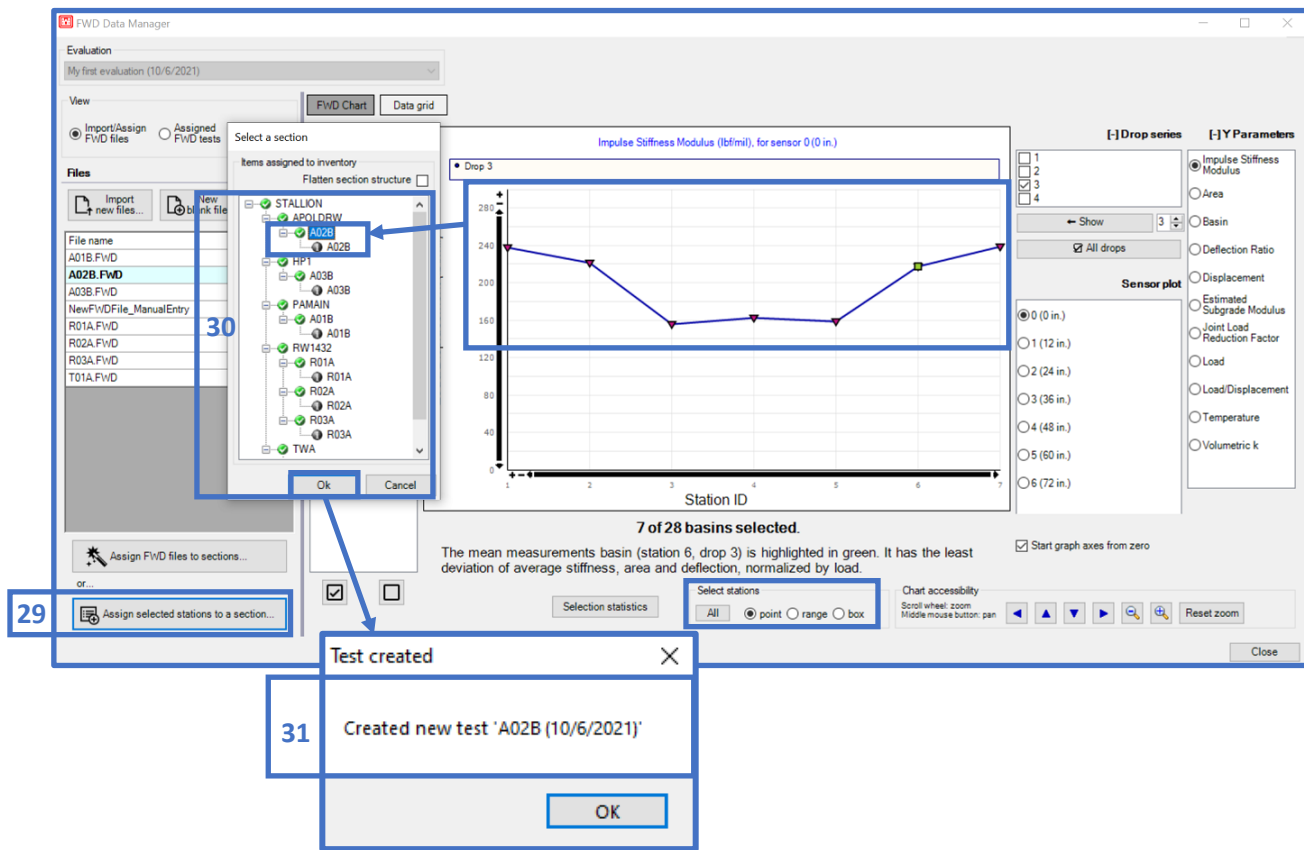
27. Based on the selected points and Y Parameters, the calculated Representative Basin will be visualized. The calculations associated with the Representative Basin are also dependent on the selected Stations and Drop series. The Representative Basin calculation is summarized as “the least deviation of average stiffness, area and deflection, normalized by load.”
28. The Y Parameters datapoint-data marker associated with the calculated representative basin is highlighted as a green square and is visible as the user toggles through the parameter options.



15.2.5 Assigning Selected FWD/HWD Data Points to Section Inventory

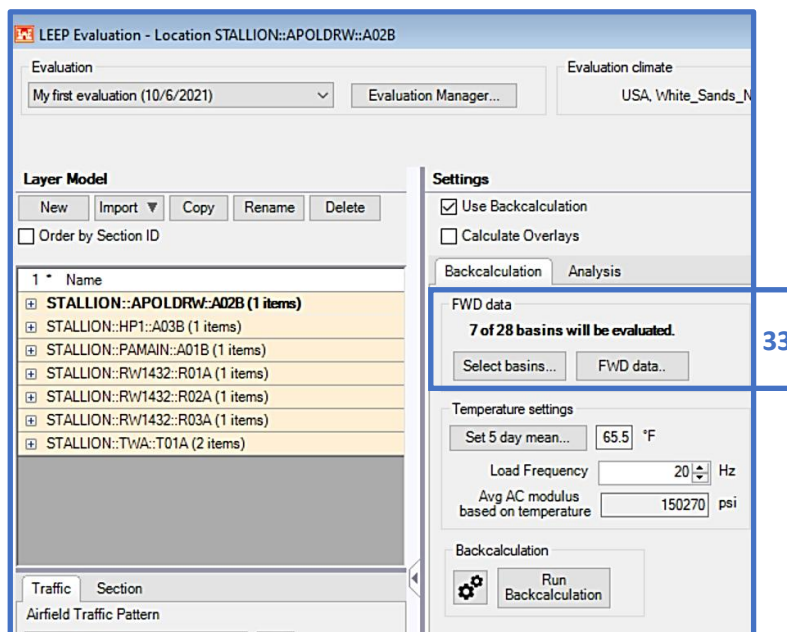
The individual FWD/HWD station data points selected using the Select Stations feature can then be assigned to inventory sections for subsequent use in LEEP backcalculation and analyses. The Representative Basin that is obtained based on the selected FWD/HWD station data points is also carried over for LEEP evaluation backcalculation and analyses.

29. Based on the selected points, Stations, and Drop series, the associated deflection basins can be assigned to an inventory section. Select Assign selected stations to section.
30. Click on a section within the Select a section form to assign the deflection basins. Select Ok to complete this process.
31. The message shown stating “Test created” indicates successful assignment.



15.2.6 Viewing Assigned FWD/HWD Data Points in LEEP

32. Navigate to the LEEP evaluation form; the assigned basins that to be evaluated during LEEP backcalculation will be displayed in the FWD data section (this is indicated by the message stating “X of XX basins will be evaluated.”).



15.3 FWD Data Example

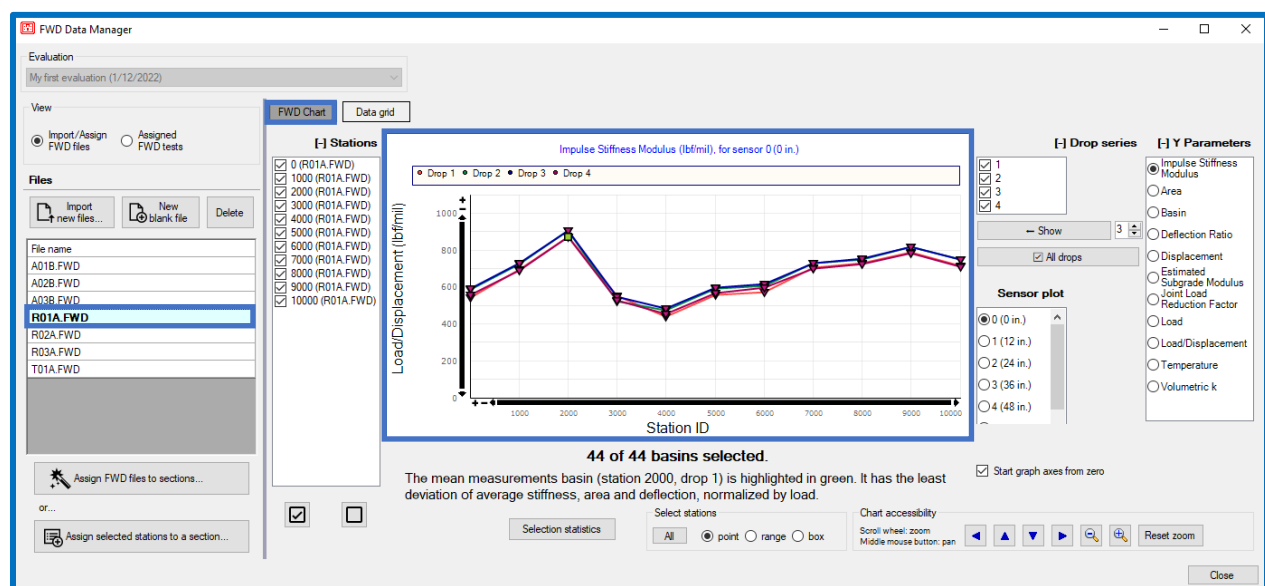
15.3.1 Perform Analysis of Pavement Using Deflection Basin Data

Pavement Engineer, Jane, at Stallion Army Airfield, observed increased pavement surface deterioration throughout Section R01A. These distresses have progressed more rapidly in the last 5-months. Jane will perform a structural evaluation with a Heavy Weight Deflectometer to gauge how these distresses may affect the service life and structural performance of the pavement section. She will use the HWD data (R01A) to perform data processing and assessment prior to LEEP Backcalculation and analysis.

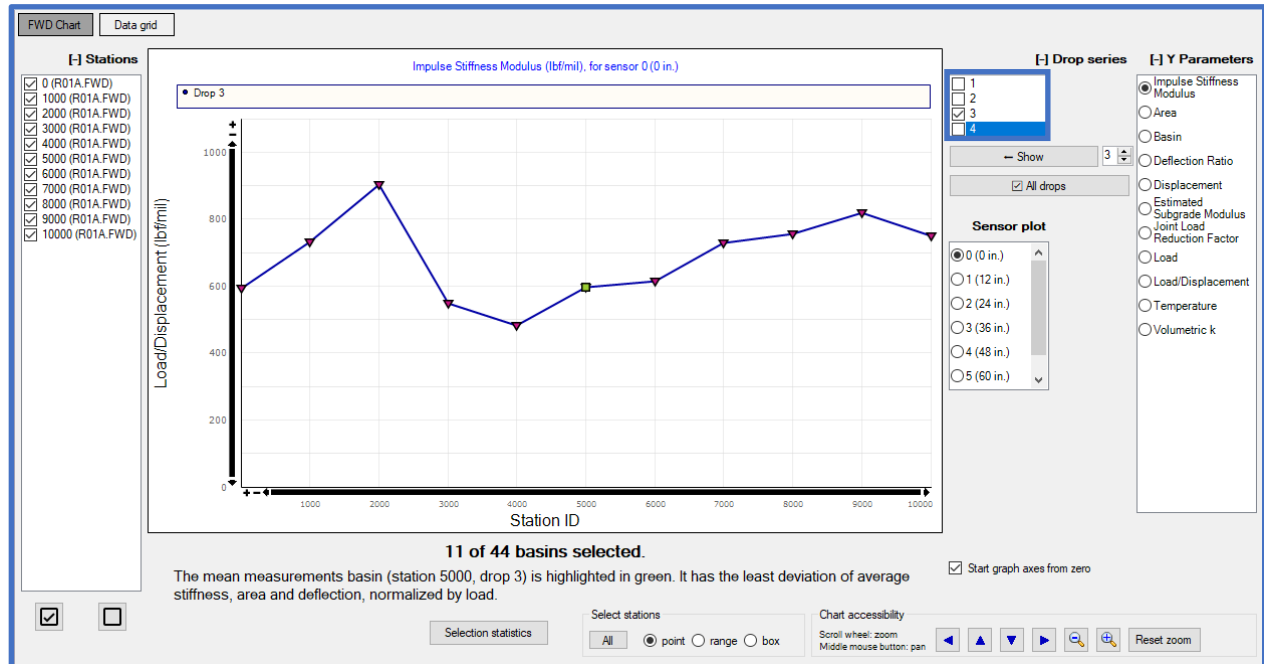
Step 1. Jane defines the pavement inventory, uploads the HWD data, and assigns data to inventory section: Stallion R01A. Instructions to perform this step-by-step process are outlined in sections 15.1 and 15.2.

Step 2. Jane toggles to the FWD data form to view the FWD Chart for section R01A.

Step 3. Given that Drop series 1 and 2 are considered as *seating drops*, they will not be considered for subsequent analysis.



Step 4. Jane uses the **Drop series** option to remove Drop series 1 (seating drop), 2 (seating drop), and 4 from the analysis. Drop series 4 is removed from analysis because she uses her engineering judgement to assume that the 4th drop series could possibly impose a minimal level of damage on the pavement; sufficient enough that she wants to remove any skew potential to the structural analysis results. As shown in the figure below, accepting the 3rd Drop series will serve as the analysis deflection data set for this case.

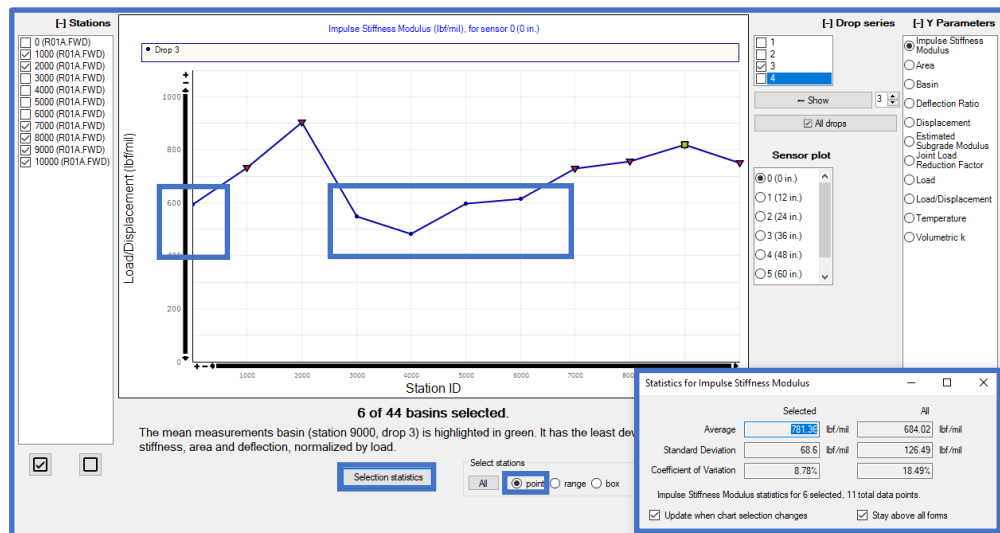


Step 5. Observing the deflection basin parameter trends by selecting Y Parameters on the FWD Data form, Jane immediately identifies that the ISM series is reflecting lower ISM values at five different stations of the section. Comparing to a distress survey, these stations spatially coincide with locations of the pavement that exhibit significantly higher levels of deterioration. ISM is the force required to displace the pavement by one mil, as measured directly under the load. By this definition, Jane observes that the lower ISM values at these five stations are consistently reflecting a lower level of stiffness/structural integrity when compared to the other stations. Jane suspects that the ISM deflection basin parameter may be a good indicator of displaying lower stiffness in the pavement considering that it spatially coincides with higher levels of distress.

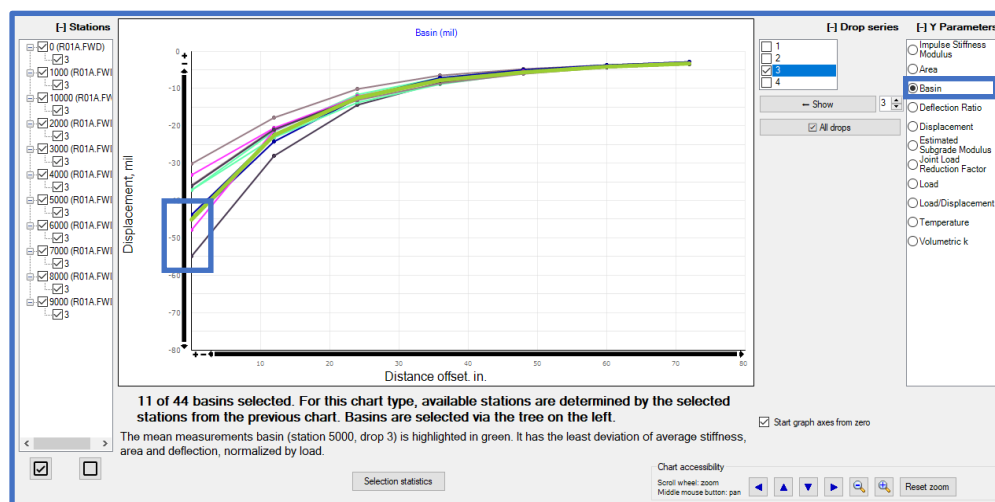
Step 6. Jane then uses the **Select stations point** function to select these five distinct stations (that are exhibiting low ISM values) on the **FWD Chart** with the **Y Parameter** set to **Impulse Stiffness Modulus**. See the figure below to view these selected stations.

Step 7. Jane selects **Selection Statistics** to view the descriptive statistics of this ISM data point selection in comparison to all the stations. There are comparative descriptive statistics shown for the **Selected** stations, and for **All** the stations.

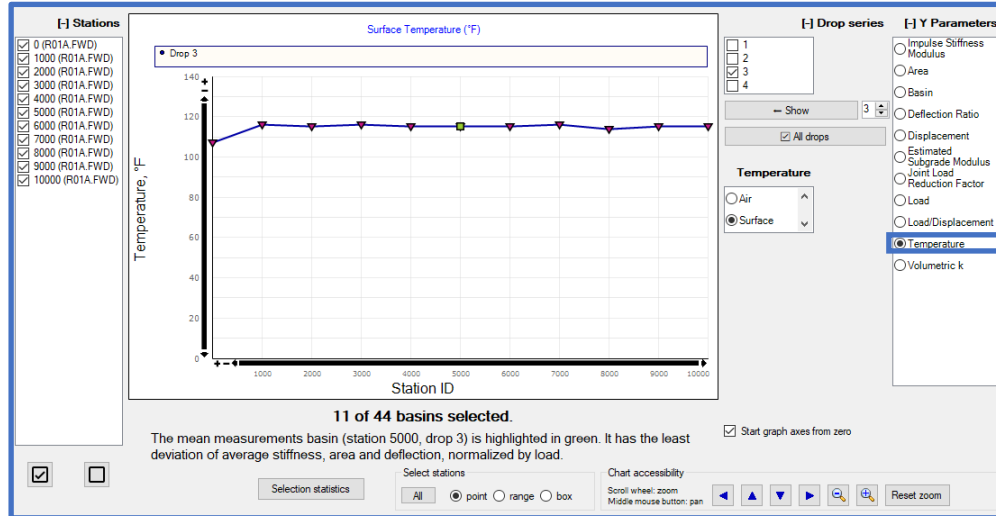
Step 8. Viewing and comparing the Coefficients of Variation (CV), it is clear that there is significant variability of the ISM trends when comparing $CV_{\text{Selected}} 8.78\%$ to $CV_{\text{All}} 18.49\%$. A preliminary conclusion could be drawn that the low ISM values (i.e., stiffness) coinciding with the highly distressed areas display relatively low variability with respect to one-another, while imposing significant variability when observed with the entire sample.



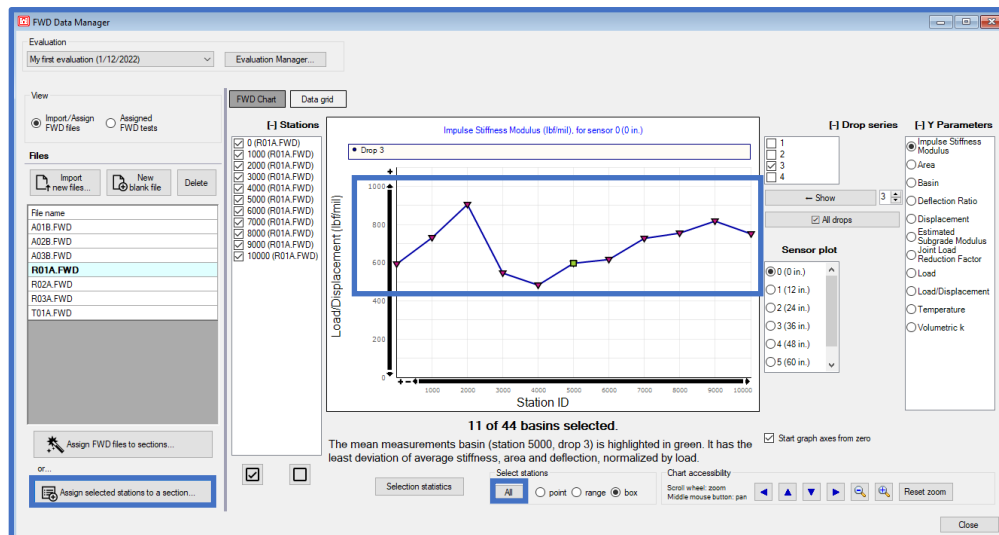
Step 9. Jane then toggles to the **Basin Y Parameters** to view the respective **Deflection Basins**. She observes that the deflection basins for these five stations with low ISM values exhibit higher displacement values for D1 when compared to the other stations. The displacement values for D2-D7 seem to be fairly consistent across all the stations.



Step 10. Jane checks the surface temperature trend (as recorded by the HWD system) to ensure that observations made on the deflection basin were not affected by significant temperature fluctuations. Observing the temperature trend, Jane confirms that the temperature on the pavement surface during data collection is mostly consistent, and not imposing any significant variability on the results. There may be some variability introduced to the surface modulus imposed by the temperature fluctuation from the first station.



Step 11. To perform subsequent modulus backcalculation and structural analysis in LEEP evaluation (to observe the backcalculated moduli, Allowable Gross Loads (AGL), and allowable passes) Jane selects All for Select Stations, followed with Assign selected stations to a section: R01A. She will perform a comparative analysis with these outputs in LEEP evaluation to observe how these highly distressed areas will affect pavement performance and structural integrity.



16 DCP Data

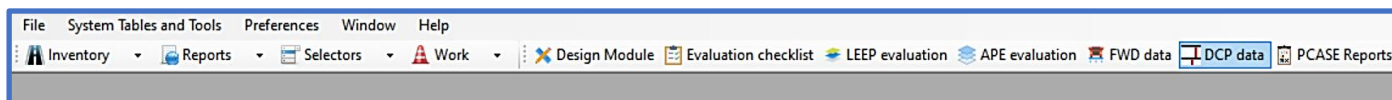
The **DCP data** form serves to process and analyze Dynamic Cone Penetrometer (DCP) readings. The readings from a single or multiple series of DCP data can be processed to calculate estimated **California Bearing Ratio (CBR)**, **Modulus of Subgrade Reaction (k)**, **Modulus of Elasticity (E)**, and **Bearing Capacity**; with profile depth. The data can also be processed graphically in order to set layer boundaries along the profile depth. These layers can be imported for subsequent LEEP and APE analyses.

Prior to beginning a new evaluation, ensure that you have opened or created a database to store the evaluation within (database name is displayed on the bottom-left of the main window). For instructions on how to import or create a database; reference Chapter 2, [Section 2.2 New/Import](#).

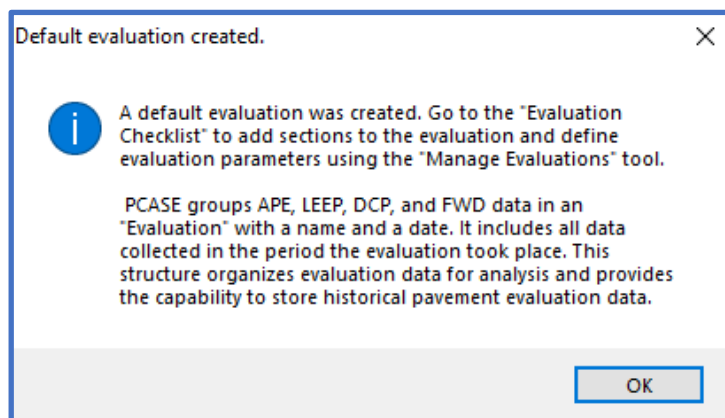
If you intend to import pavement structures; ensure you have defined your inventory (unless you will be creating sections Ad Hoc); reference Chapter 7, [Section 7.1 Define Inventory](#).

16.1 Getting Started

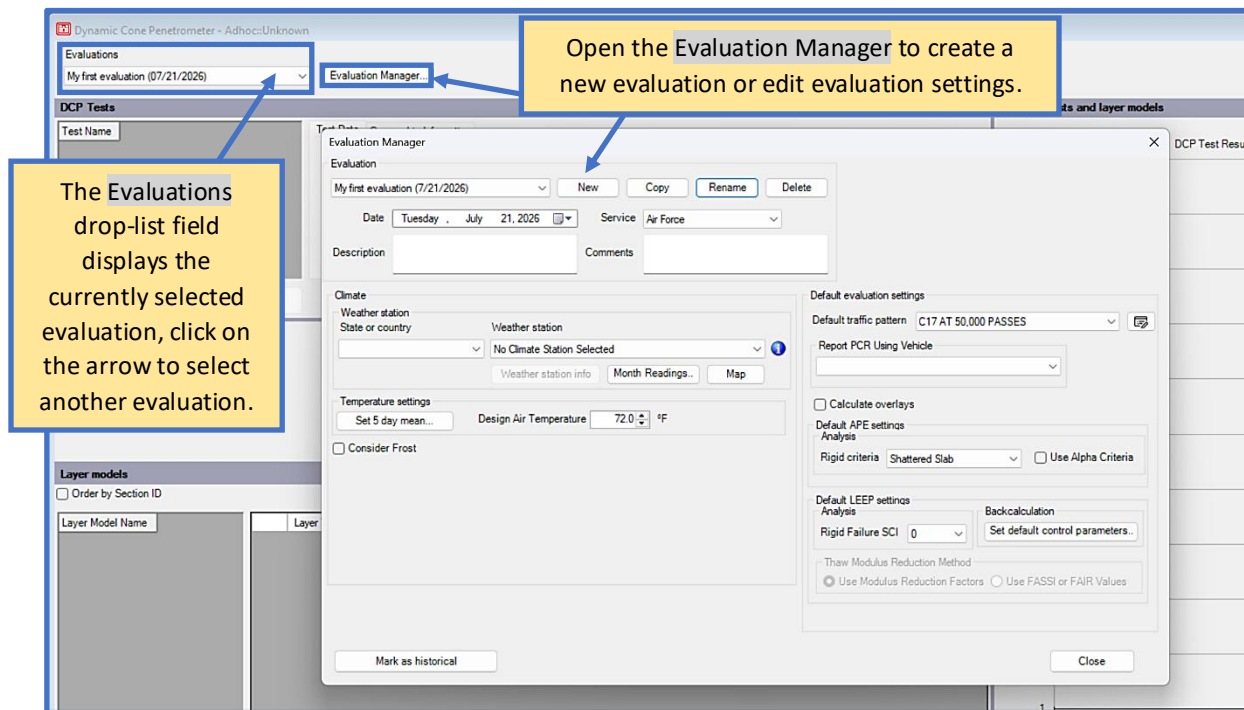
Select **DCP data** on the PCASE 7 toolbar to open the evaluation tool.



If you have not imported or created an evaluation in the current database, the message below will display to indicate a default evaluation was created. Click **OK** to continue.



You can rename the default evaluation or create a new evaluation by selecting **Evaluation Manager** (accessible through the **DCP data** form). If you have historical data that you've imported from an earlier version of PCASE or created an evaluation in the **Evaluation Checklist**, use the drop-down list to select the evaluation.



16.2 DCP Data form

As shown in the blank form below, the DCP Data form is organized in three sections; DCP Tests, Layer Models, and Graph of tests and layer models. The Blows and Penetration grid displays when data is provided.

A grid displays here when blows and penetrations data are available.

Layer Model Name	Layer Type	Material Type	Thickness (in.)	Weighted Average CBR %	Correlated Modulus (psi)

16.2.1 Evaluation Manager

Evaluation Manager serves to establish global analysis parameters. To navigate Evaluation Manager; reference Chapter 12 Evaluation Checklist, [Section 12.3 Evaluation Manager](#).

16.2.2 DCP Tests

The DCP Tests panel includes controls to manage test data. The grid on the left lists test names for the currently selected Evaluation. Below the grid are buttons which allow you to create a New test, Rename an existing test, or Delete a test. The Test Data tab consists of fields that allow you to input starting depth and surface course thickness values. The Output option is now locked to CBR since PCR implementation. The Penetration reading units radio buttons correlate with the Blows and Penetrations grid data. *Note: Changing units using Penetration reading units, only converts units displayed in the Cumulative penetration reading column. Units displayed within the entire DCP Data form can be changed in Preferences.*

Tests can be assigned to inventory sections using the Assign tests to sections form.

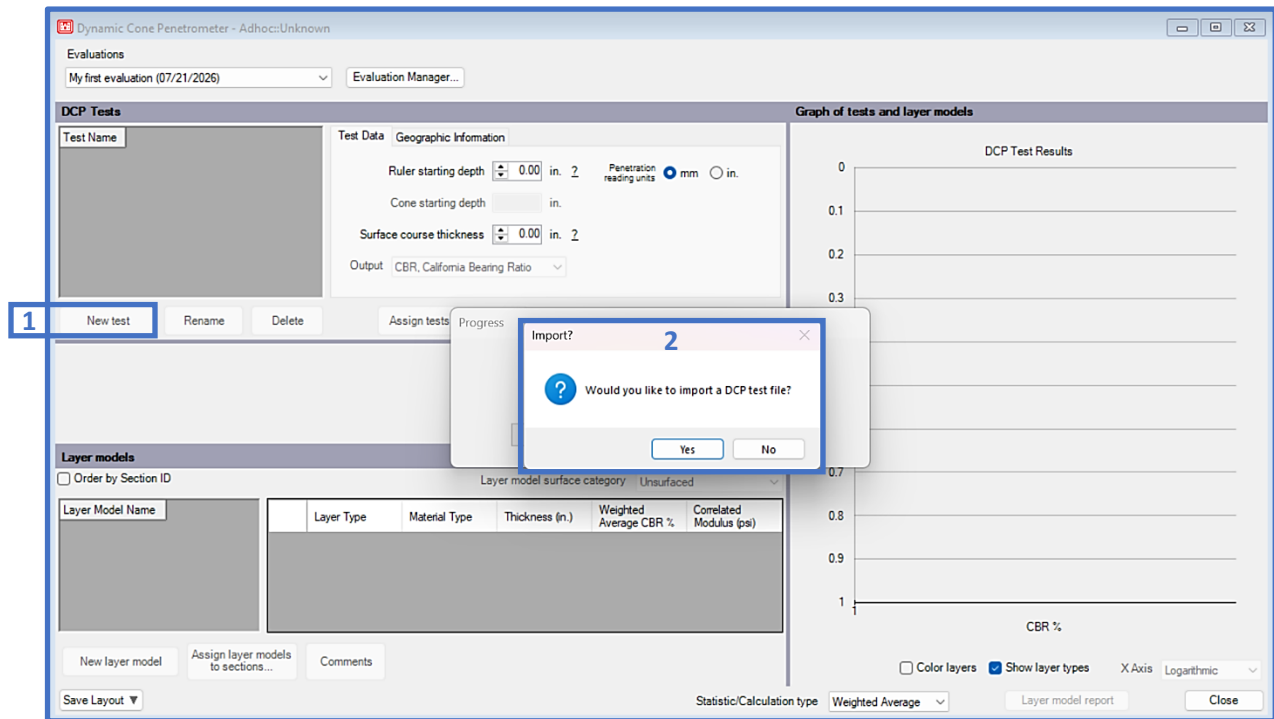
The Geographic Information tab contains fields for location information. This function has not been fully implemented. In a future version the fields will populate with data derived from imported tests.

The screenshot shows the 'DCP Tests' panel. On the left, a tree view lists tests under 'A01B': 'R01A - Test 01' and 'R02A - Test 01', 'R02A - Test 02'. Below the list are buttons: 'New test', 'Rename', 'Delete', and 'Assign tests to sections...'. On the right, the 'Test Data' tab is active, showing fields for 'Ruler starting depth' (0.00 in.), 'Cone starting depth' (6.06 in.), 'Surface course thickness' (6.00 in.), and 'Output' (CBR, California Bearing Ratio). There are also radio buttons for 'Penetration reading units' (mm selected, in. unselected).

The Blows and Penetration grid displays Blows, Cumulative penetration readings, Hammer size, Soil Type, CBR%, and Total depth for each selected test. Values can be edited directly in the grid, except read-only values (cells colored in gray).

	Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth (in.)
▶ 0	170.0	170.0	1 - Large	1 - All Soils	0.0	6.69
1	175.0	175.0	1 - Large	1 - All Soils	48.1	6.89
5	180.0	180.0	1 - Large	1 - All Soils	100.0	7.09
10	195.0	195.0	1 - Large	1 - All Soils	100.0	7.68
10	215.0	215.0	1 - Large	1 - All Soils	100.0	8.46
10	245.0	245.0	1 - Large	1 - All Soils	85.3	9.65
8	270.0	270.0	1 - Large	1 - All Soils	81.5	10.63
6	290.0	290.0	1 - Large	1 - All Soils	75.8	11.42
6	305.0	305.0	1 - Large	1 - All Soils	100.0	12.01

1. Select **New Test** to create a new test file.
2. Select **Yes** to import a **DCP test file** or **No** to manually enter penetration readings.
 - a. If **Yes**; navigate to the file(s) location. You can select a single **DCP test file** for import or multiple files to batch import. Select **Open** to complete the import process.
 - b. If **No**; enter a unique descriptive name within the **Test Name** form, then select **OK**.



3. Data can be copied from an Excel spreadsheet and pasted directly into the grid. Once you have the data copied, select the first cell within the **Blows** column and right-click to paste the readings.

3

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	170	1
1	175	1
5	180	1
10	195	1
10	215	1
10	245	1
8	270	1
6	290	1
6	305	1
8	350	1
5	375	1
5	405	1
5	430	1
5	455	1
5	485	1
5	505	1
5	520	1
5	535	1
7	555	1
7	585	1
7	630	1
4	665	1
4	700	1
3	730	1

Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth (in.)
0	170.0	1 - Large	1 - All Soils	0.0	6.69
1	175.0	1 - Large	1 - All Soils	48.1	6.89
5	180.0	1 - Large	1 - All Soils	100.0	7.09
10	195.0	1 - Large	1 - All Soils	100.0	7.68
10	215.0	1 - Large	1 - All Soils	100.0	8.46
10	245.0	1 - Large	1 - All Soils	85.3	9.65
8	270.0	1 - Large	1 - All Soils	81.5	10.63
6	290.0	1 - Large	1 - All Soils	75.8	11.42

- To manually input DCP readings, select **Insert Reading** to add rows and enter values.

Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth (in.)
0	170.0	1 - Large	1 - All Soils	0.0	6.69
1	175.0	1 - Large	1 - All Soils	48.1	6.89

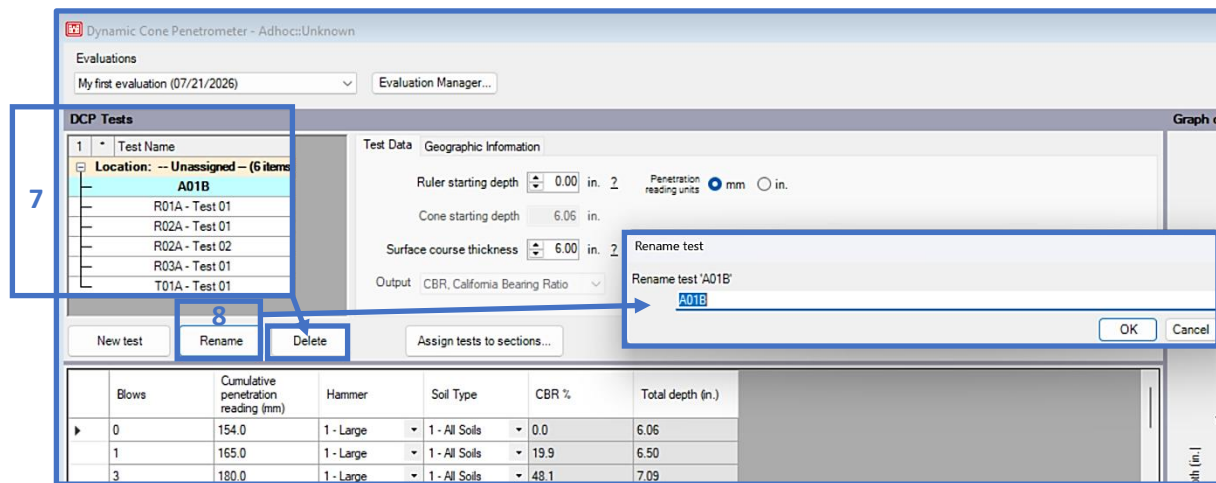
- Select the **Hammer** size: **1- Large** (17.6-lb) or **2-Small** (10.1-lb). The rest of the rows below automatically change to the same selection.

	Blows	Cumulative penetration reading (mm)	Hammer 5	Soil Type	CBR %	Total depth (in.)
▶	0	170.0	1 - Large	1 - All Soils	0.0	6.69
	1	175.0	1 - Large 2 - Small	1 - All Soils	48.1	6.89
	5	180.0	1 - Large	1 - All Soils	100.0	7.09
	10	195.0	1 - Large	1 - All Soils	100.0	7.68
	10	215.0	1 - Large	1 - All Soils	100.0	8.46
	10	245.0	1 - Large	1 - All Soils	85.3	9.65
	8	270.0	1 - Large	1 - All Soils	81.5	10.63

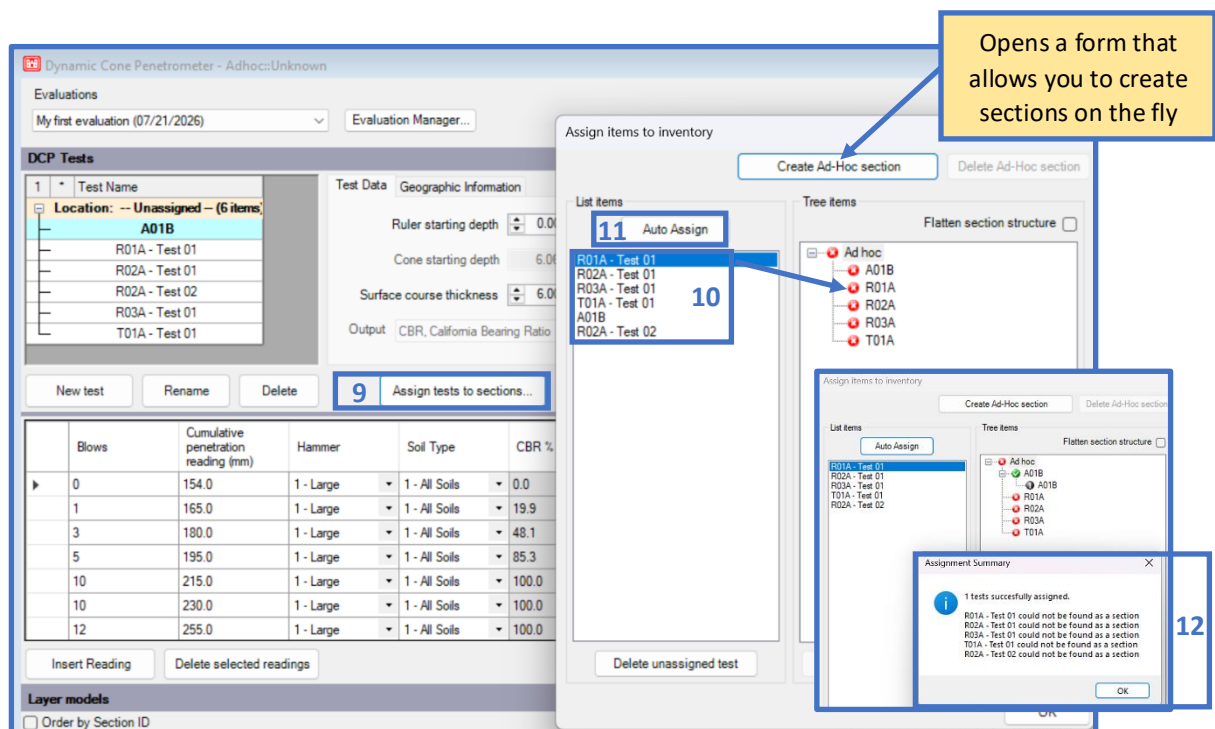
- Select the **Soil Type**: **1-All Soils**, **2-Heavy Clay**, or **3-Lean Clay**. The rest of the rows below automatically change to the same selection.

	Blows	Cumulative penetration reading (mm)	Hammer	Soil Type 6	CBR %	Total depth (in.)
▶	0	170.0	1 - Large	1 - All Soils	0.0	6.69
	1	175.0	1 - Large	1 - All Soils 2 - Heavy Clay	48.1	6.89
	5	180.0	1 - Large	3 - Lean Clay 4 - AFSOC DCP	100.0	7.09
	10	195.0	1 - Large	1 - All Soils	100.0	7.68
	10	215.0	1 - Large	1 - All Soils	100.0	8.46
	10	245.0	1 - Large	1 - All Soils	85.3	9.65
	8	270.0	1 - Large	1 - All Soils	81.5	10.63

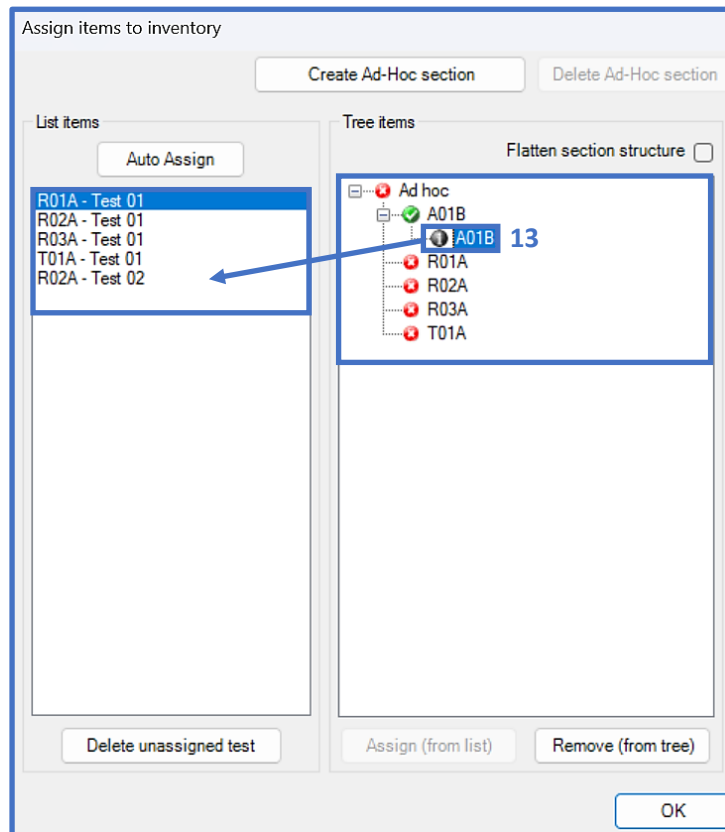
- If you wish to remove a test; select an item from the **DCP Tests** grid, then click on the **Delete** button.
- To rename a test from the **DCP Tests** inventory; select a **Test Name**, then click on the **Rename** button and follow the prompts to update the current name.



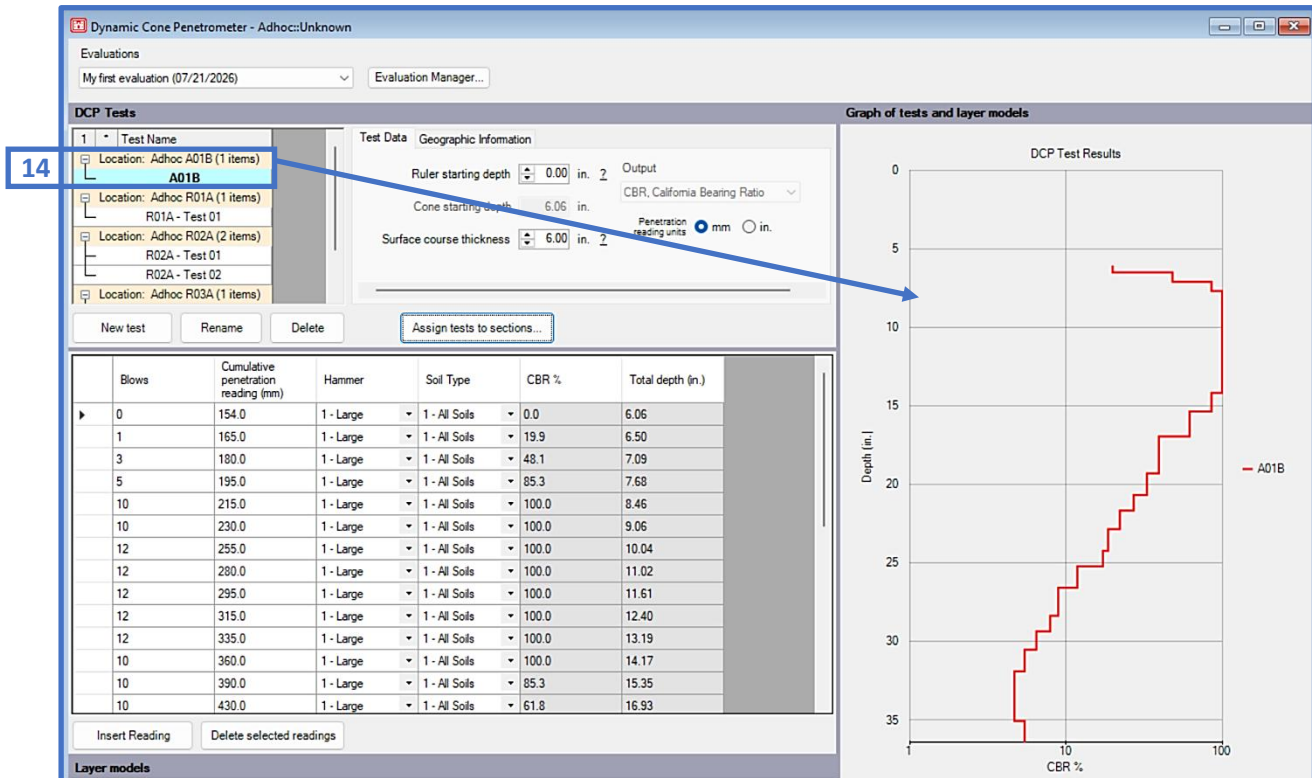
9. Select **Assign tests to sections** to assign individual DCP test files to sections.
10. Once the **Assign items to inventory** form opens, drag each individual DCP test file in the inventory to the associated network section.
11. Select **Auto Assign** to automatically assign multiple DCP tests files to the appropriate section. *Note: The DCP test file name must be consistent with the section name for Auto Assign to be successful.*
12. A completed **Auto Assign** will provide an assignment summary. Select **OK** to close the window.



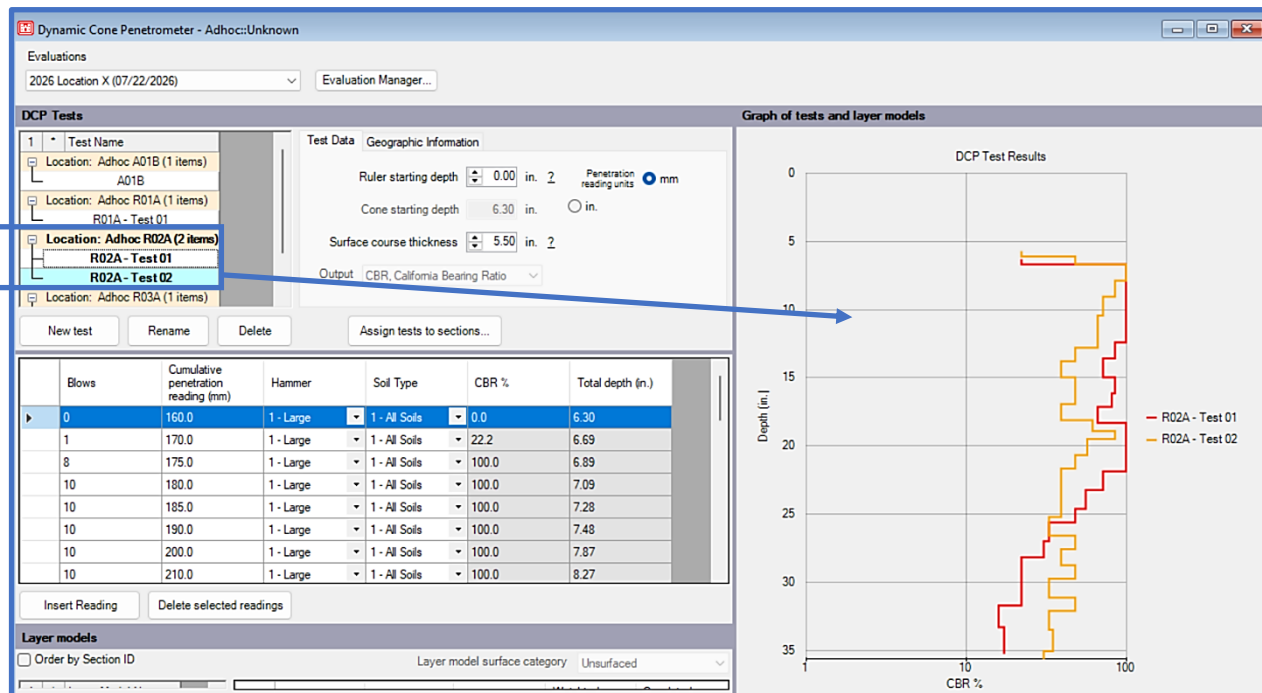
13. You can remove assigned DCP test files from sections by selecting a test from the Items assigned to inventory box and dragging it to the Unassigned items box.



14. To visualize an individual DCP profile, select a DCP Test Name; the plot will display on the DCP Test Results chart.



15. Multiple series of DCP test files can be visualized on the DCP Test Results chart by selecting a DCP test file from the Test Name list, then dragging your cursor downward until you're satisfied with the selection. *Note: Selected Test Name fields will become highlighted in blue with bold text.* You can also select multiple files by maintaining Ctrl on a keyboard and selecting each individual file.



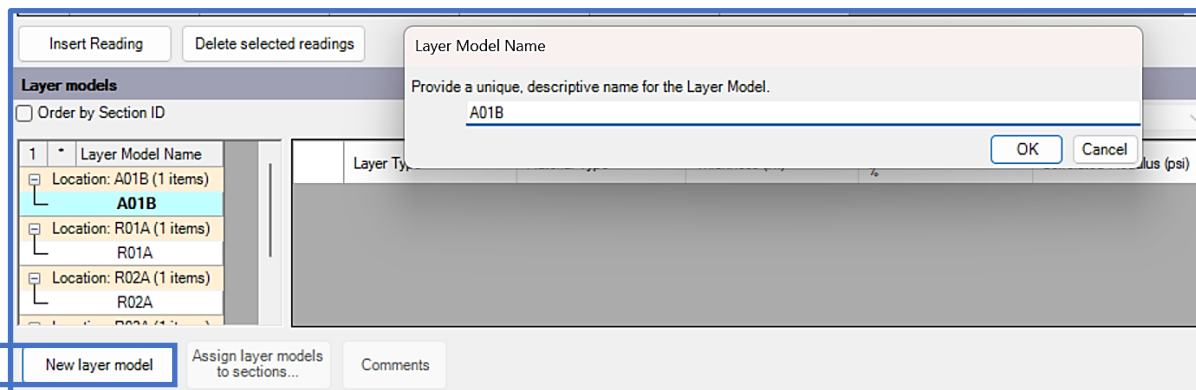
16.2.3 Layer models

The **Layer models** panel consists of a grid on the left that lists each **Layer model** name, functions for creating and deleting layer models, and a layer model grid with associated grid functions beneath. The **Save Layout** function allows you to adjust the panels within the form and save a configuration. You may also delete a previously saved layout by clicking on the arrow to select the **Delete saved layout** option.

Layer Model Name	Location	Layer Type	Material Type	Thickness (in.)	Weighted Average CBR %	Correlated Modulus (psi)
A01B	Location: A01B (1 items)	Asphalt Concrete	Asphalt Cement	5.00		
R01A	Location: R01A (1 items)	Base	Unbound Aggregate	7.00	88.0	64,254.7
R02A	Location: R02A (1 items)	Subbase	Unbound Aggregate	11.00	54.0	46,346.5
R02A	Location: R02A (1 items)	Natural Subgrade	Cohesionless Cut	5.50	29.0	30,576.7

The **Layer model surface category** field is editable if the layer model has not been assigned to a section.

16. To create a layer model, select **New layer model**, then input a distinctive name within the **Layer Model Name** field. As discussed in steps 13 and 14; select the associated **DCP Tests** for the corresponding layer models.



16

17. Prior to performing a DCP analysis, establish the utilized Surface Course Thickness convention that was employed during data collection. Roll over the  icon to view a diagram of the accepted conventions within PCASE 7.
18. The Cone Starting Depth field is displayed, but cannot be edited. This value is derived from test data.
19. See the info icon for guidance inputting Ruler starting depth.

	Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %
0		154.0	1 - Large	1 - All Soils	0.0
1		165.0	1 - Large	1 - All Soils	19.9
3		180.0	1 - Large	1 - All Soils	48.1
5		195.0	1 - Large	1 - All Soils	85.3
10		215.0	1 - Large	1 - All Soils	100.0
10		230.0	1 - Large	1 - All Soils	100.0
12		255.0	1 - Large	1 - All Soils	100.0
12		280.0	1 - Large	1 - All Soils	100.0

20. Toggle between the radio buttons to select the appropriate measurement unit for Penetration reading units. The selected unit will only be reflected in the Cumulative penetrating reading column cells.
21. The output parameter for DCP analysis is now locked to CBR, California Bearing Ratio. In version 7.0.8, columns were added to the layer model grid that display k-values or modulus values obtained from correlations from the CBR values. These values update automatically, as the layer model CBR values change.

DCP Tests

1 • Test Name

- Location: Adhoc A01B (1 items)
 - A01B**
- Location: Adhoc R01A (1 items)
 - R01A - Test01**
- Location: Adhoc R02A (2 items)
 - R02A - Test 01
 - R02A - Test 02
- Location: Adhoc R03A (1 items)

New test Rename Delete Assign tests to sections...

Insert Reading Delete selected readings

Layer models

☐ Order by Section ID Layer model surface category: Flexible (from section)

1 • Layer Model Name	Layer Type	Material Type	Thickness (in.)	Weighted Average CBR %	Correlated Modulus (psi)
Location: A01B (1 items)	Asphalt Concrete	Asphalt Cement	5.00		
A01B	Base	Unbound Aggregate	7.00	87.8	64,156.9
Location: R01A (1 items)	Subbase	Unbound Aggregate	11.00	54.2	46,461.3
R01A	Natural Subgrade	Cohesionless Cut	5.50	28.7	30,364.7
Location: R02A (1 items)					

Test Data Geographic Information

Ruler starting depth: 0.00 in. 2 Penetration reading units: ☒ mm ☐ in. 20

Cone starting depth: 6.69 in.

Surface course thickness: 5.00 in. 2

21 Output: CBR, California Bearing Ratio

22. A form to assign GPS coordinates to each DCP test is available under **Geographic Information**. However, this function has not been fully implemented yet.

DCP Tests

1 • Test Name

- Location: Adhoc A01B (1 items)
 - A01B**
- Location: Adhoc R01A (1 items)
 - R01A - Test01**
- Location: Adhoc R02A (2 items)
 - R02A - Test 01
 - R02A - Test 02
- Location: Adhoc R03A (1 items)

New test Rename Delete Assign tests to sections...

Test Data Geographic Information 22

Latitude: 0 Longitude: 0 Altitude: 0 yd

23. When a layer model is created, the **Layer Type** drop-lists in each grid cell can be used to select different layer types.
24. The **Material Type** for each layer can be changed using the drop-lists.
25. The thickness for each layer is reflected in the **Thickness** column. This field is dynamic and will change when you move the boundary layers on the **Graph of test and layer models** chart. Likewise, a data entry change in the **Thickness** field will be reflected within the **Graph of test and layer models** chart.
26. Select a **Statistic/Calculation type** (calculated **Average**, **Weighted Average**, **Minimum**, **Eighty-fifth percentile**, or **Fifteenth percentile**) to display results in terms of the selected output parameter.
27. An automation algorithm is available to identify separate layers based on deviation in the CBR with profile depth. Input (or scroll to) the total number of layers to use for the algorithm, then select **Auto-break Layers** to initiate the function. The output layer configuration displays in the layer model grid and on the **Graph of tests and layer models** chart.
28. Assign layer models to sections can be used to assign layer structures to sections, if the test data was not previously assigned to sections upon layer model creation. Ad-hoc sections can also be created from this form.
29. Select **Round Values** to round layer model CBR values.

23	24	Thickness (in.)	Weighted Average CBR %	Correlated Modulus (psi)
Asphalt Concrete	Asphalt Cement	5.00		
Base	Unbound Aggregate	7.00	87.8	64,156.9
Subbase	Unbound Aggregate	11.00	54.2	46,461.3
Natural Subgrade	Cohesionless Cut	5.50	28.7	30,364.7

25 26

27 28 29

26 Statistic/Calculation type Weighted Average

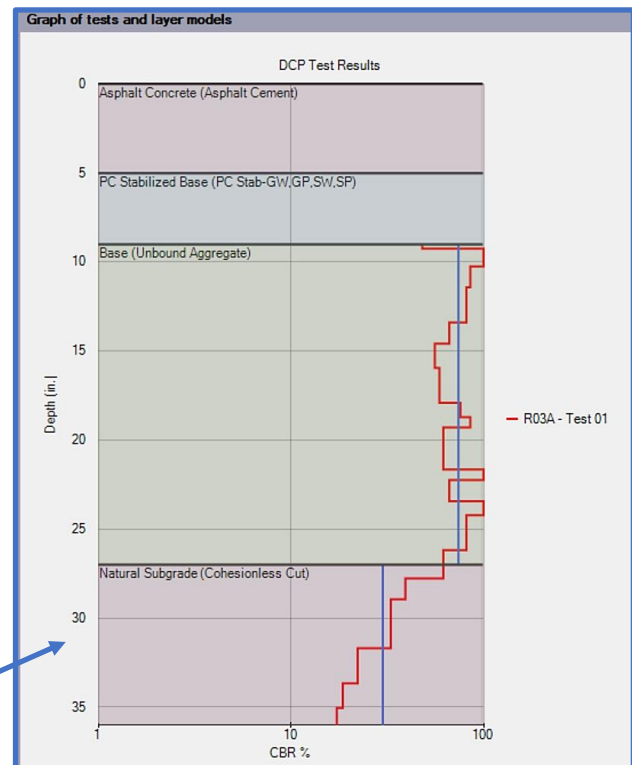
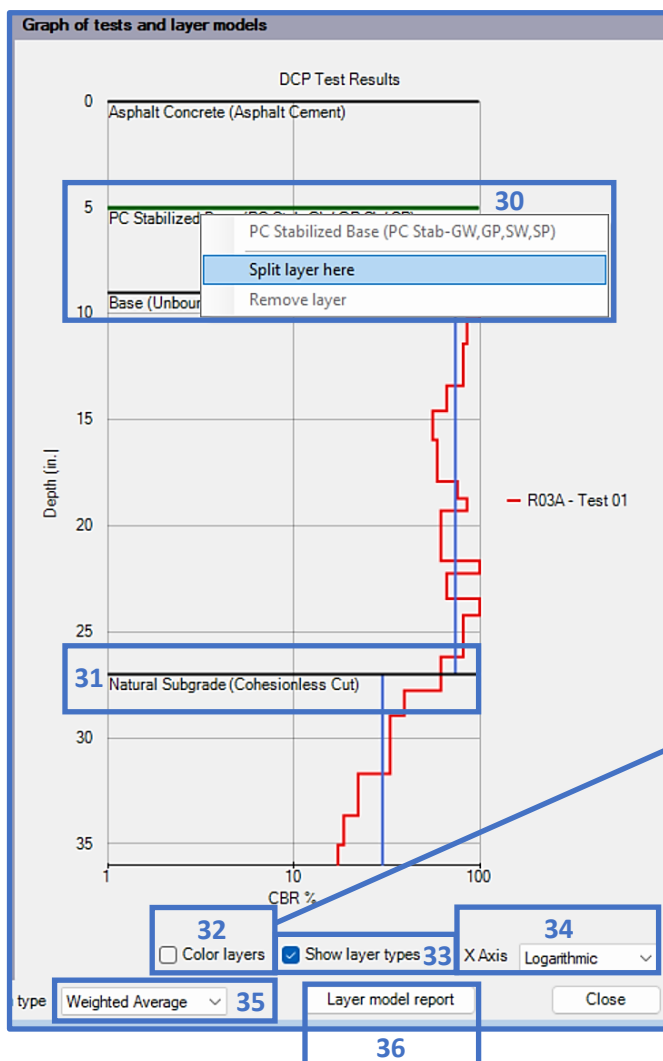
Correlated modulus or k-values, based on CBRs for each layer

16.2.4 Graph of tests and layer models

As part of the DCP analysis; the **Graph of tests and layer models** chart can be used to graphically add and remove layer boundaries, or adjust the plotted **Statistic/Calculation type** values.

30. Right-click on a layer boundary, then select **Split Layer here** to add a layer boundary at that location of the plot. A layer boundary can also be removed; right-click, then select **Remove Layer**.
31. Each layer boundary can be adjusted within the chart by left-clicking on the layer boundary and dragging the cursor up or down to the desired value.

32. Turn on the **Color layers** feature to add a more distinct visual indication of layer separation.
33. **Show layer types** is turned on by default. Uncheck the checkbox to hide the layer type names.
34. Select between **Linear** or **Logarithmic** display options for the chart's **X-Axis**.
35. The selected **Statistic/Calculation type** values can also be adjusted within the chart by selecting and dragging the blue line in the chart to the desired value. Value changes made on the chart will automatically be reflected in the appropriate layer model grid column.
36. **Layer model report** outputs a layer model summary report. The **DCP Data** report (test data summary) is available for selection within the **PCASE Reports** window.



16.3 DCP Examples

16.3.1 Importing a DCP File and Layer Model Creation

Part of the following example is from the PCASE evaluation workshop. The materials for the full exercise can be found at the following link:

<https://transportation.erdc.dren.mil/tsmcx/training.aspx>

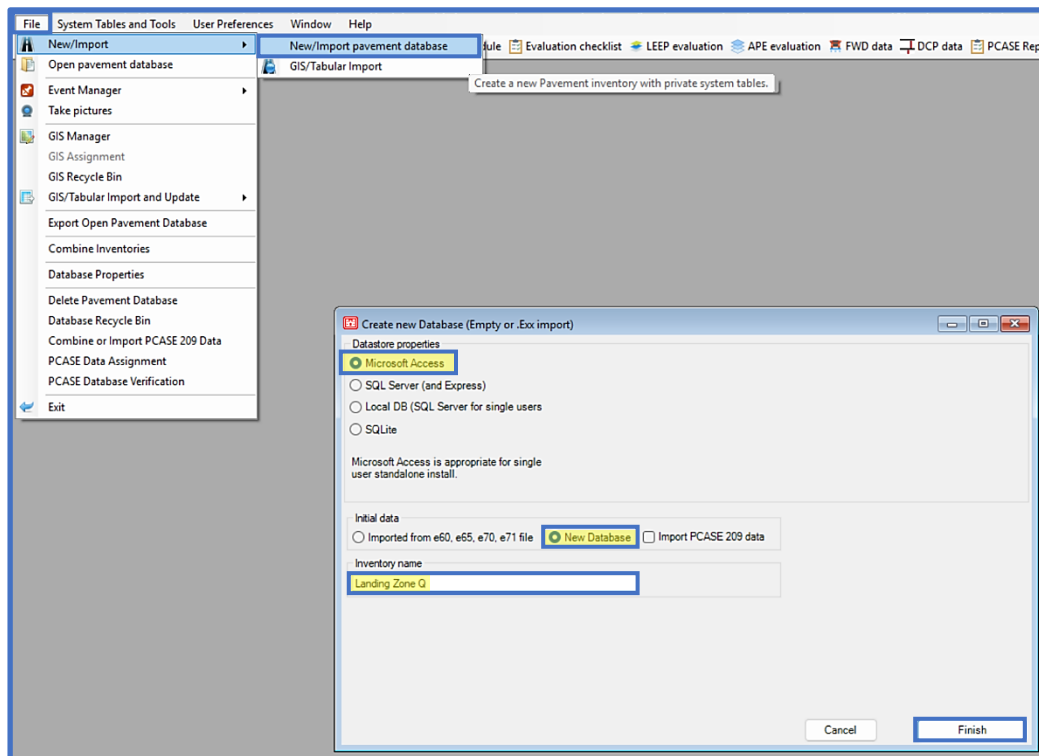
In this example you will perform the following tasks.

- Create a new database and evaluation
- Import multiple DCPs at one time
- Create an inventory via ad-hoc sections
- Assign test data to sections
- Create layer models

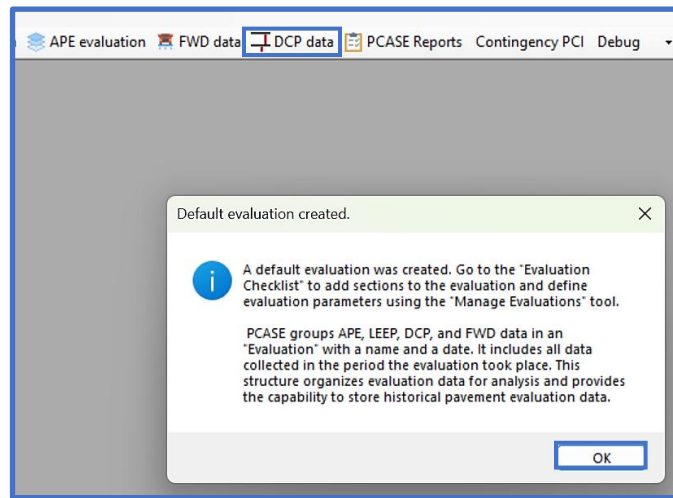
Landing Zone Q

Step 1. Create a new database for location “Landing Zone Q”

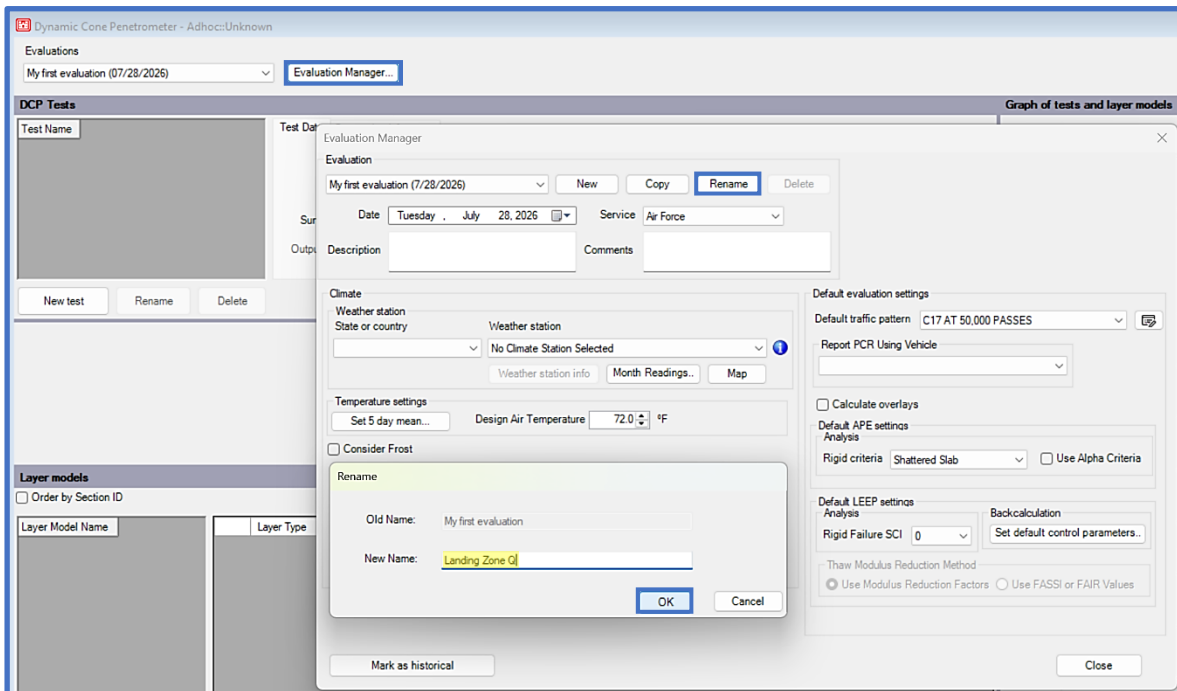
- Open the File menu
- Select New/Import pavement database
- Use Microsoft Access under Datastore properties
- Select New Database for Initial data
- Input “Landing Zone Q” for Inventory name
- Click on Finish to create the new database



- Select **DCP data** from the toolbar to create a new default evaluation. Click on **OK** to confirm that an evaluation will be created.



- The DCP data form opens blank. Select **Evaluation Manager** to define parameters for the evaluation.
- Select **Rename** and name the evaluation “Landing Zone Q”. Click on **OK**.



- Set the evaluation's **Service** to **Air Force**, then close the Evaluation Manager.

Evaluation Manager

Evaluation
Landing Zone Q (7/28/2026) [v] [New] [Copy] [Rename] [Delete]

Date Tuesday, July 28, 2026 [v] Service Air Force [v]

Description [] Comments []

Step 2: Import DCP tests

- On the DCP form, select **New test**.
- Select **Yes** to confirm that you would like to import a test file.
- Browse to the DCP files in File Explorer. Select Test 2, Shift button, then select Test 4 to multi-select all 3 files. Click on the Open button.

Dynamic Cone Penetrometer - Adhoc:Unknown

Evaluations
Landing Zone Q (07/28/2026) [v] [Evaluation Manager...]

DCP Tests

Test Name [] Test Data [v] Geographic Information [v]

Ruler starting depth 0.00 in. 2 Penetration reading units [mm] [in.]

Cone starting depth [] in.

Surface course thickness 0.00 in. 2

Output CBR, California Bearing Ratio [v]

[New test] [Rename] [Delete] [Assign tests to sections...]

Select DCP File(s)

PCASE Evaluation Workshop - Feb 2026 > Landing Zone Q > DCP Data

Name	Date modified	Type	Size
Test 2.TXT	12/1/2023 2:51 PM	Text Document	1 KB
Test 3.TXT	11/1/2021 9:37 PM	Text Document	1 KB
Test 4.TXT	11/1/2021 9:37 PM	Text Document	1 KB

File name: Test 4.TXT* Test 2.TXT* Test 3.TXT* [v] [Text files (*.txt)]

[Open] [Cancel]

Import?

Would you like to import a DCP test file?

[Yes] [No]

Step 3. Create ad-hoc sections and assign tests

- The imported tests should now be displayed within the DCP Tests list.
- Select Assign tests to sections
- Click on the Create Ad-Hoc section button.

The screenshot shows the 'Dynamic Cone Penetrometer - Ad-hoc:Unknown' window. The 'DCP Tests' list on the left contains 'Test 2.TXT', 'Test 3.TXT', and 'Test 4.TXT'. The 'Assign tests to sections...' dialog is open, showing the 'List items' section with the three tests selected. The 'Tree items' section is empty. The 'Create Ad-Hoc section' button is highlighted. The background shows a table of test results with columns: Blows, Cumulative penetration reading (mm), Hammer, Soil Type, and CBR %.

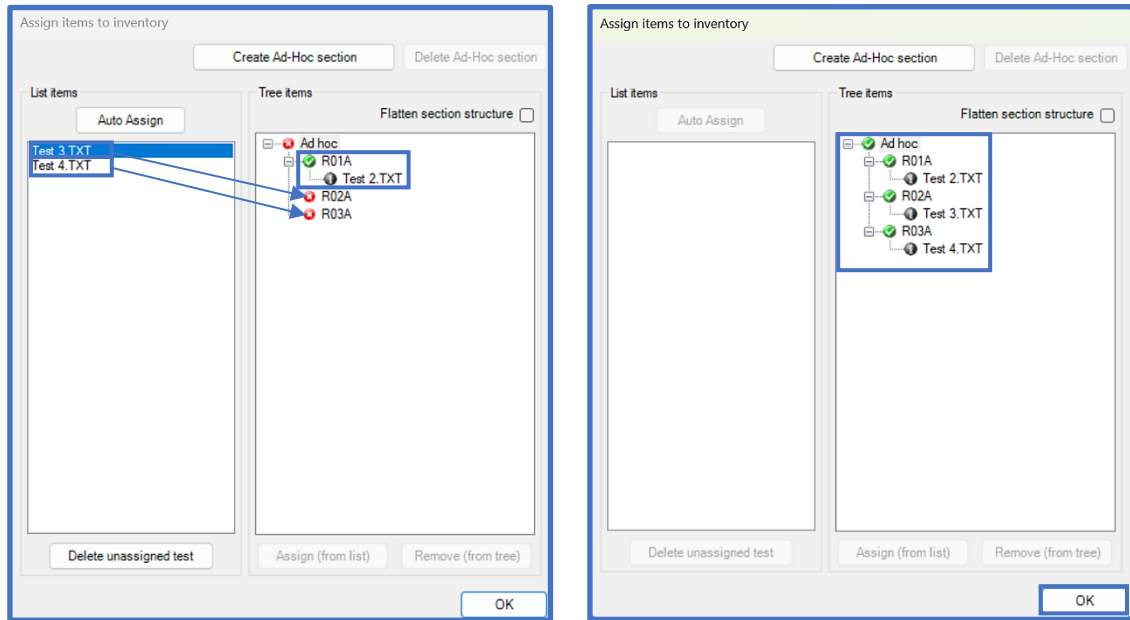
Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %
0	0.0	1 - Large	1 - All Soils	0.0
1	43.2	1 - Large	1 - All Soils	4.3
1	78.7	1 - Large	1 - All Soils	5.3
1	127.0	1 - Large	1 - All Soils	3.8
1	154.9	1 - Large	1 - All Soils	7.0
2	180.3	1 - Large	1 - All Soils	16.9
3	210.8	1 - Large	1 - All Soils	21.8

- Add sections R01A, R02A and R03A. Select the Add row button to create subsequent sections. Set all three sections to Runway for Pavement Use and GR – Gravel for the Surface Type.
- After all sections have been added, click OK.

The screenshot shows the 'Add ad-hoc sections to an evaluation' dialog box. The table has columns: PID, Pavement Use, and Surface Type. The table contains three rows: R01A, R02A, and R03A, all with 'RUNWAY' for Pavement Use and 'GR - Gravel' for Surface Type. The 'Add Row' button is highlighted.

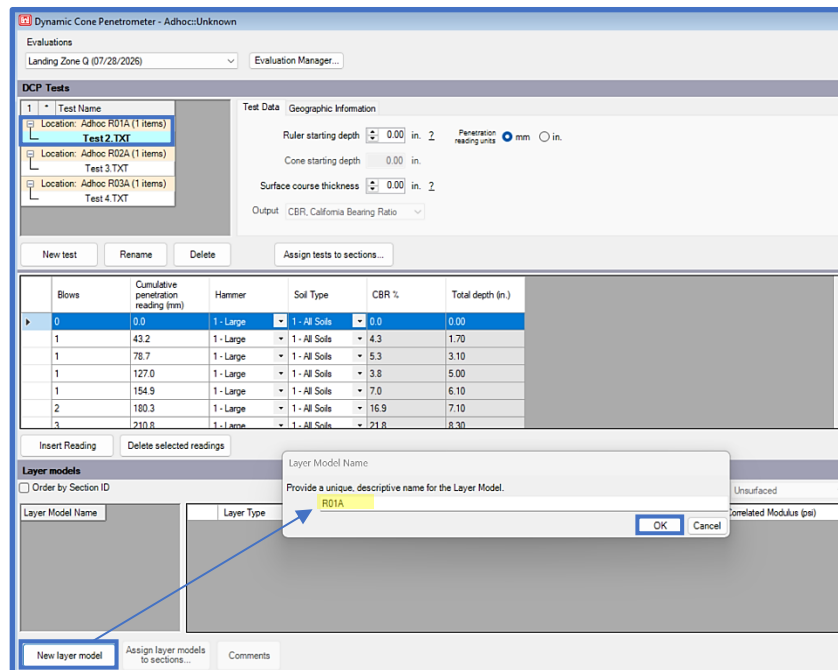
PID	Pavement Use	Surface Type
R01A	RUNWAY	GR - Gravel
R02A	RUNWAY	GR - Gravel
R03A	RUNWAY	GR - Gravel

- Select Test 2, then drag it over to section R01A. A green circle with a checkmark is displayed to signify the test has been successfully assigned.
- Drag Test 3 to section R02A and Test 4 to section R03A.
- After all tests are assigned, click **OK**.

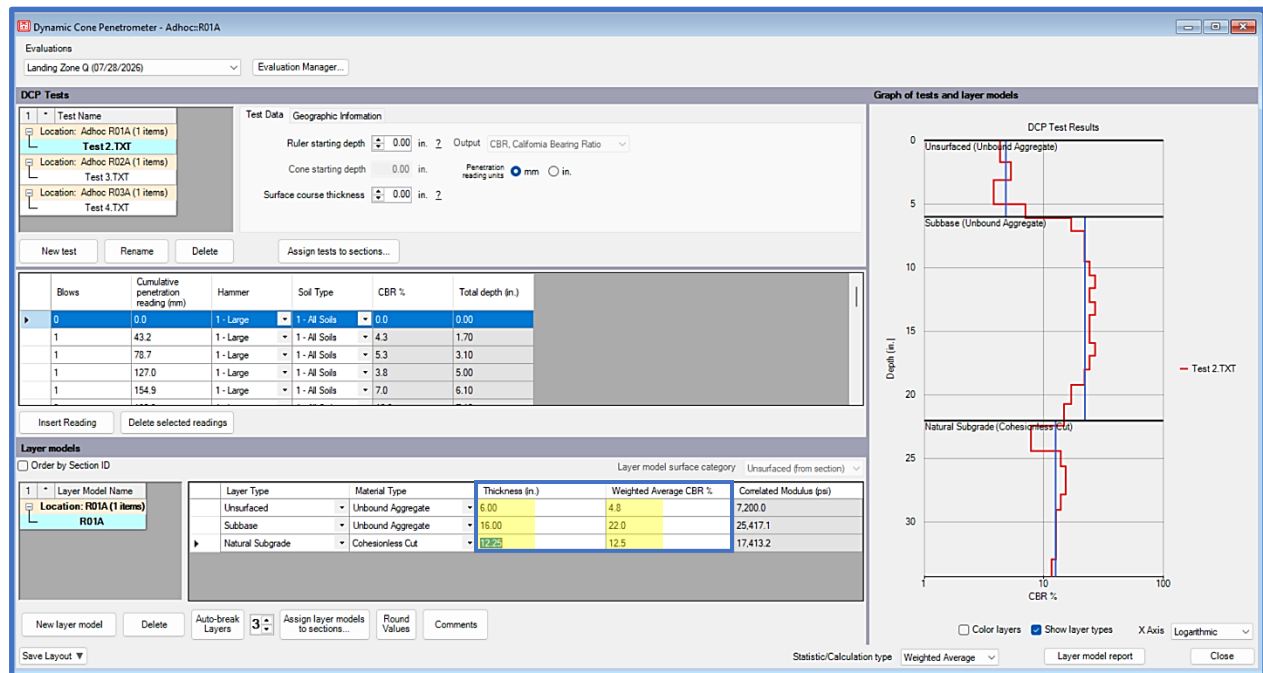


Step 4: Create layer models from test files

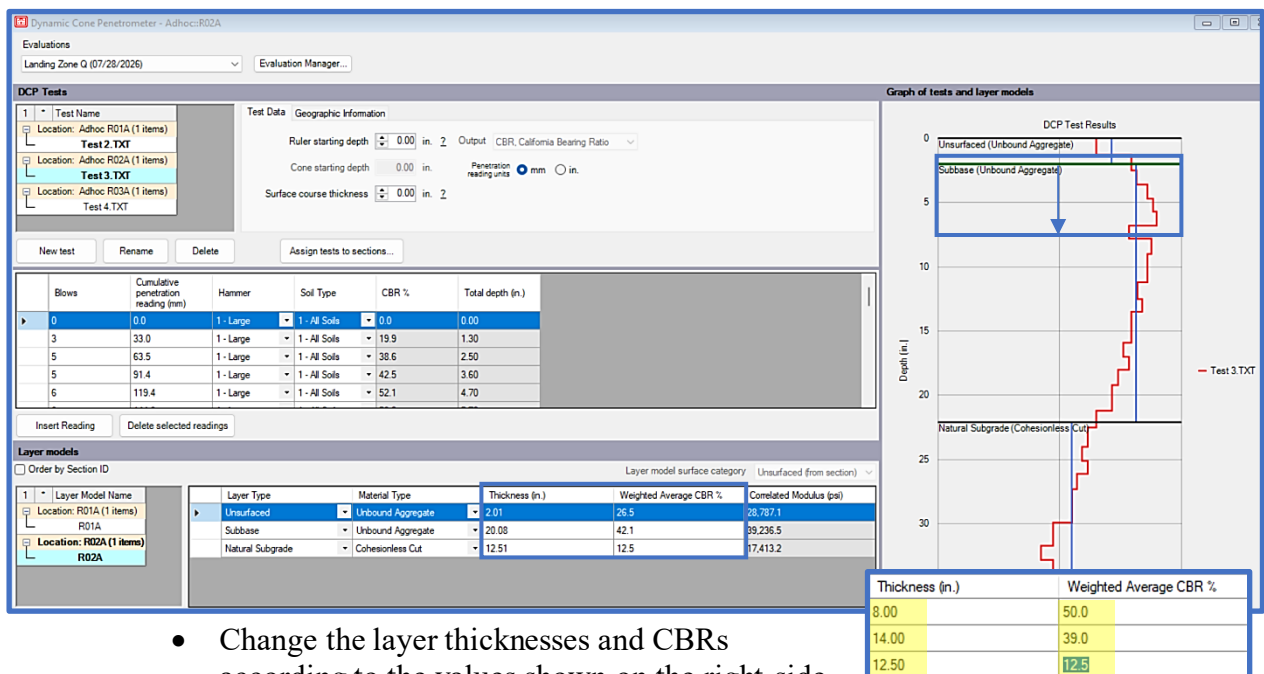
- Select Test 2 from the **DCP Tests** list.
- Select **New layer model**.
- Name the layer model R01A.



- The layer structure is displayed. Ensure that the layer thicknesses and CBRs match the values shown below – the values can be edited directly within the grid.

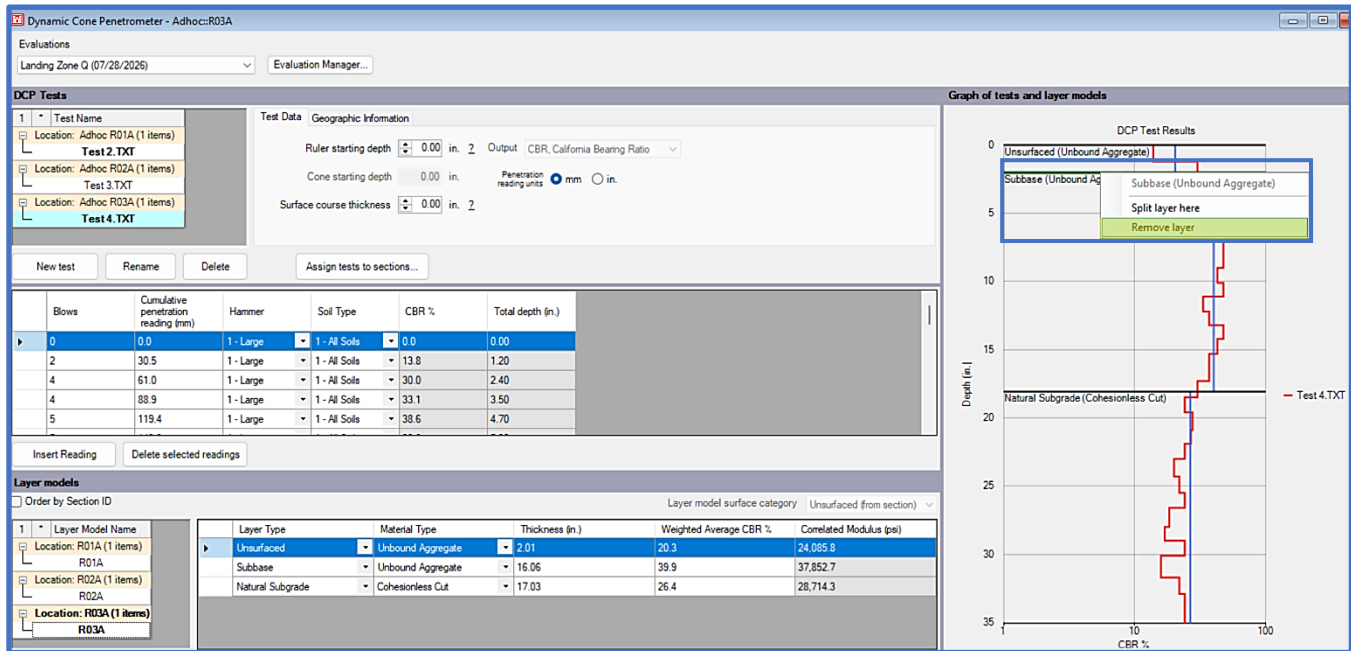


- Select Test 3 and repeat the same steps to create a layer model for R02A.
- Change the unsurfaced layer thickness to 8" by selecting the Subbase layer boundary on the test results graph, then drag the line to a depth of 8".
- Update the unsurfaced layer's CBR to 50.

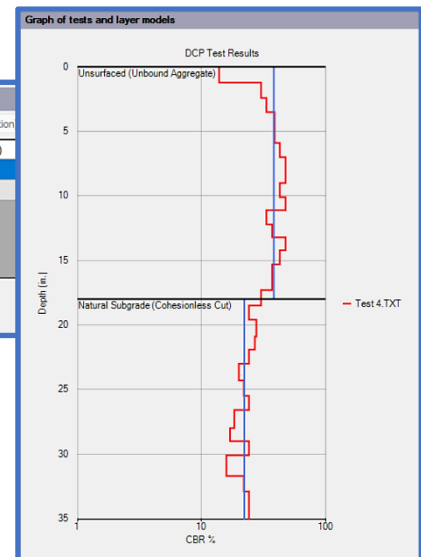
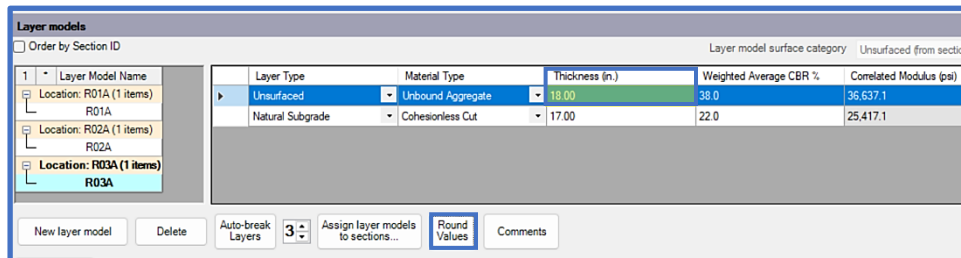


- Change the layer thicknesses and CBRs according to the values shown on the right-side.

- Select Test 4, then click on the **New layer model** button to create a layer model for R03A.
- Remove the Subbase layer by mousing over the layer boundary within the graph, then right-click and select **Remove layer**.



- Change the unsurfaced layer thickness to 18”.
- Select **Round values**.



- That completes this exercise. You can close the DCP form if you are finished.
- If you would like to continue this exercise; reference the PCASE evaluation workshop. *Note: The step that instructs how to import the Contingency Traffic pattern was skipped in this example. If you choose to continue with importing these layer models into APE evaluation, refer back to that step before analyzing the structures.*

16.3.2 Manual Data Entry of DCP Data and Performing Analysis

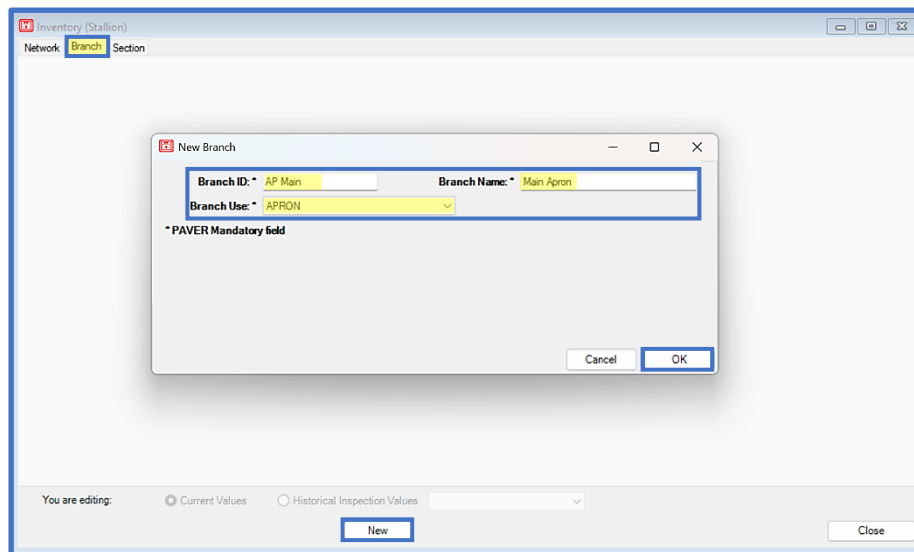
Process the DCP penetration data using the following analysis conditions:

- Network: Stallion, Branch: AP MAIN, Section: A01B (Flexible)
- Perform manual data entry of the DCP penetration readings
- Evaluation Type: APE
- Hammer type: 17.6-lb hammer
- Soil type: mostly non-cohesive soil
- Surface Course Thickness: 6-in.
- Adjust layer breaks within DCP Test Results graph
- X Axis: toggle between Linear and Logarithmic
- Compare Statistic/Calculation Type: Weighted Average and Average
- Import DCP layer model into APE evaluation and run analysis

Stallion AAF; AP Main, Section A01B

Step 1. Define an Inventory

- Use the Inventory drop-list and select Define Inventory
- Name the Network: Stallion AAF
- Select New on the Branch tab
- Input “AP Main” for the Branch ID, “Main Apron” for Branch Name, and select apron for Branch Use
- Click OK



- Select the **Section** tab
- Click the **New** button
- Input “A01B” in the **Section ID** field and select AC from the **Surface Type** drop-list
- Click on **OK**, then close the inventory form

Step 2. Add the section to a new evaluation

- Select **Evaluation Checklist** from the toolbar
- A default evaluation is created and a notification message is displayed, select **OK**
- Select **Evaluation Manager**
- Rename the default evaluation as shown below, then click **OK** and close the Evaluation Manager

- Select **Add all sections** on the Evaluation Checklist form, the section that was created using the inventory form populates
- Click on the **Close** button

Step 3. Manually input DCP data

- Select **DCP data** on the toolbar to open the form
- To create a new DCP analysis, select **New test**
- The prompt will ask if a **DCP test file** is to be imported. For this example, select **No**; the **DCP data** will be entered manually.

- Name the test “A01B – Test 01”
- Click **OK**

Test Name

Provide a unique, descriptive name for the test.

A01B - Test 01

OK

Cancel

- Copy and Paste the values from all three columns in the table below into in Excel spreadsheet
- Copy the values from the spreadsheet

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	154	1
1	165	1
3	180	1
5	195	1
10	215	1
10	230	1
12	255	1
12	280	1
12	295	1
12	315	1
12	335	1
10	360	1
10	390	1
10	430	1
5	460	1
5	490	1
5	525	1
3	550	1
3	580	1
3	615	1
2	640	1
2	675	1
2	720	1
1	745	1
1	775	1
1	810	1
1	850	1
1	890	1
1	925	1

- Select the first cell in the **Blows** column and right-click to **Paste** the copied values

The screenshot shows the 'Dynamic Cone Penetrometer - Adhocc:Unknown' software window. The 'Evaluations' section shows 'Station AAF, NM (08/18/2026)'. The 'DCP Tests' section shows a test named 'A01B-Test01'. The 'Test Data' section shows 'Ruler starting depth' at 0.00 in, 'Cone starting depth' at 0.00 in, and 'Surface course thickness' at 0.00 in. The 'Output' is set to 'CBR, California Bearing Ratio'. The 'Blows' column in the table is highlighted, and a right-click context menu is open, showing the 'Paste' option. The background shows a spreadsheet with values for 'Blows', 'Cumulative penetration reading (mm)', 'Hammer', 'Soil Type', 'CBR %', and 'Total depth (in.)'.

Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth (in.)
0	0.0	1 - Large	1 - All Soils	0.0	0.00
1	154	1 - Large	1 - All Soils	0.0	0.00
3	165	1 - Large	1 - All Soils	0.0	0.00
5	180	1 - Large	1 - All Soils	0.0	0.00
10	195	1 - Large	1 - All Soils	0.0	0.00
12	215	1 - Large	1 - All Soils	0.0	0.00
12	230	1 - Large	1 - All Soils	0.0	0.00
12	255	1 - Large	1 - All Soils	0.0	0.00
12	280	1 - Large	1 - All Soils	0.0	0.00
12	295	1 - Large	1 - All Soils	0.0	0.00
12	315	1 - Large	1 - All Soils	0.0	0.00
12	335	1 - Large	1 - All Soils	0.0	0.00
10	360	1 - Large	1 - All Soils	0.0	0.00
10	390	1 - Large	1 - All Soils	0.0	0.00
10	430	1 - Large	1 - All Soils	0.0	0.00
5	460	1 - Large	1 - All Soils	0.0	0.00
5	490	1 - Large	1 - All Soils	0.0	0.00
5	525	1 - Large	1 - All Soils	0.0	0.00
3	550	1 - Large	1 - All Soils	0.0	0.00
3	580	1 - Large	1 - All Soils	0.0	0.00
3	615	1 - Large	1 - All Soils	0.0	0.00
2	640	1 - Large	1 - All Soils	0.0	0.00
2	675	1 - Large	1 - All Soils	0.0	0.00
2	720	1 - Large	1 - All Soils	0.0	0.00
1	745	1 - Large	1 - All Soils	0.0	0.00
1	775	1 - Large	1 - All Soils	0.0	0.00
1	810	1 - Large	1 - All Soils	0.0	0.00
1	850	1 - Large	1 - All Soils	0.0	0.00
1	890	1 - Large	1 - All Soils	0.0	0.00
1	925	1 - Large	1 - All Soils	0.0	0.00

- The readings values should populate within the grid as shown below

The screenshot shows the 'Dynamic Cone Penetrometer - Adhocc:Unknown' software window. The 'Evaluations' section shows 'Station AAF, NM (08/18/2026)'. The 'DCP Tests' section shows a test named 'A01B-Test01'. The 'Test Data' section shows 'Ruler starting depth' at 0.00 in, 'Cone starting depth' at 6.06 in, and 'Surface course thickness' at 6.06 in. The 'Output' is set to 'CBR, California Bearing Ratio'. The 'Blows' column in the table is populated with values from a spreadsheet. The background shows a spreadsheet with values for 'Blows', 'Cumulative penetration reading (mm)', 'Hammer', 'Soil Type', 'CBR %', and 'Total depth (in.)'.

Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth (in.)
10	390.0	1 - Large	1 - All Soils	85.3	15.35
10	430.0	1 - Large	1 - All Soils	61.8	16.93
5	460.0	1 - Large	1 - All Soils	39.3	18.11
5	490.0	1 - Large	1 - All Soils	39.3	19.29
5	525.0	1 - Large	1 - All Soils	33.0	20.67
3	550.0	1 - Large	1 - All Soils	27.2	21.65
3	580.0	1 - Large	1 - All Soils	22.2	22.83
3	615.0	1 - Large	1 - All Soils	18.6	24.21
2	640.0	1 - Large	1 - All Soils	17.3	25.20
2	675.0	1 - Large	1 - All Soils	11.8	26.57
2	720.0	1 - Large	1 - All Soils	8.9	28.35
1	745.0	1 - Large	1 - All Soils	7.9	29.33
1	775.0	1 - Large	1 - All Soils	6.5	30.51
1	810.0	1 - Large	1 - All Soils	5.4	31.89
1	850.0	1 - Large	1 - All Soils	4.7	33.46
1	890.0	1 - Large	1 - All Soils	4.7	35.04
1	925.0	1 - Large	1 - All Soils	5.4	36.42

- Alternatively, readings data can be manually entered within the DCP readings penetration grid. To manually input DCP readings, select the **Insert Reading** button or the second cell in the **Blows** column and enter a value. To input the associated **Cumulative penetration reading** value, you can either select the cell field with your cursor or press Tab on the keyboard to toggle to the next field. Once the Blows and Cumulative penetration reading values are entered for a row, press Tab on the keyboard to generate a new row. Readings can be removed from the grid by selecting the row you would like to delete, then click on the **Delete selected readings** button.

Step 3. Assign test data to sections

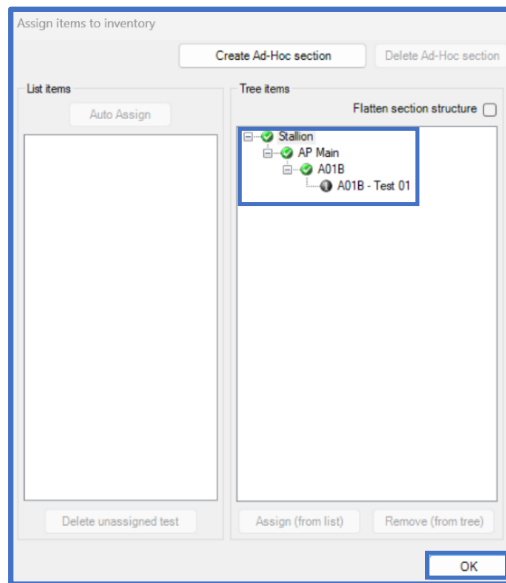
- Select **Assign tests to sections**

The screenshot shows the 'DCP Tests' application window. The main data table is as follows:

	Blows	Cumulative penetration reading (mm)	Hammer	Soil Type	CBR %	Total depth
	10	390.0	1 - Large	1 - All Soils	85.3	15.35
	10	430.0	1 - Large	1 - All Soils	61.8	16.93
	5	460.0	1 - Large	1 - All Soils	39.3	18.11
	5	490.0	1 - Large	1 - All Soils	39.3	19.29
	5	525.0	1 - Large	1 - All Soils	33.0	20.67
	3	550.0	1 - Large	1 - All Soils	27.2	21.65
	3	580.0	1 - Large	1 - All Soils	22.2	22.83
	3	615.0	1 - Large	1 - All Soils	18.6	24.21
	2	640.0	1 - Large	1 - All Soils	17.3	25.20
	2	675.0	1 - Large	1 - All Soils	11.8	26.57
	2	720.0	1 - Large	1 - All Soils	8.9	28.35
	1	745.0	1 - Large	1 - All Soils	7.9	29.33
	1	775.0	1 - Large	1 - All Soils	6.5	30.51
	1	810.0	1 - Large	1 - All Soils	5.4	31.89
	1	850.0	1 - Large	1 - All Soils	4.7	33.46
	1	890.0	1 - Large	1 - All Soils	4.7	35.04
	1	925.0	1 - Large	1 - All Soils	5.4	36.42

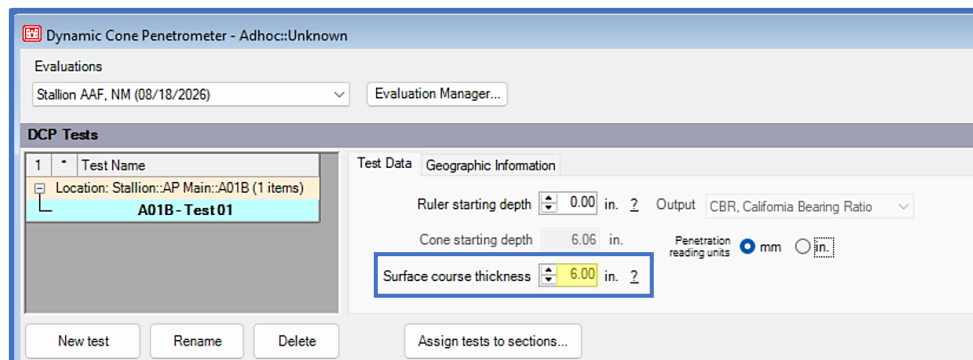
The 'Assign tests to sections...' dialog box is open, showing a list of items on the left and a tree structure on the right. The tree structure shows a hierarchy: Stallion > AP Main > A01B. The 'Assign (from list)' button is highlighted.

- Select “A01B - Test 01” from the List items box and drag it to “A01B” in the Tree items box, the nodes on the tree will turn green to exemplify that the assignment was successful, click OK

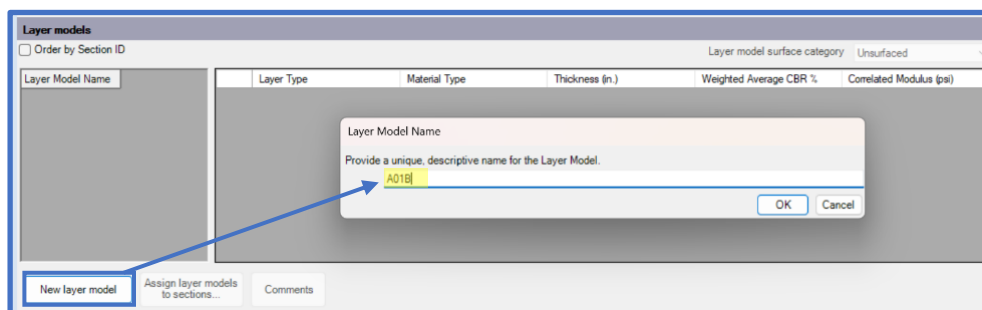


Step 4. Create a layer model and adjust layer properties

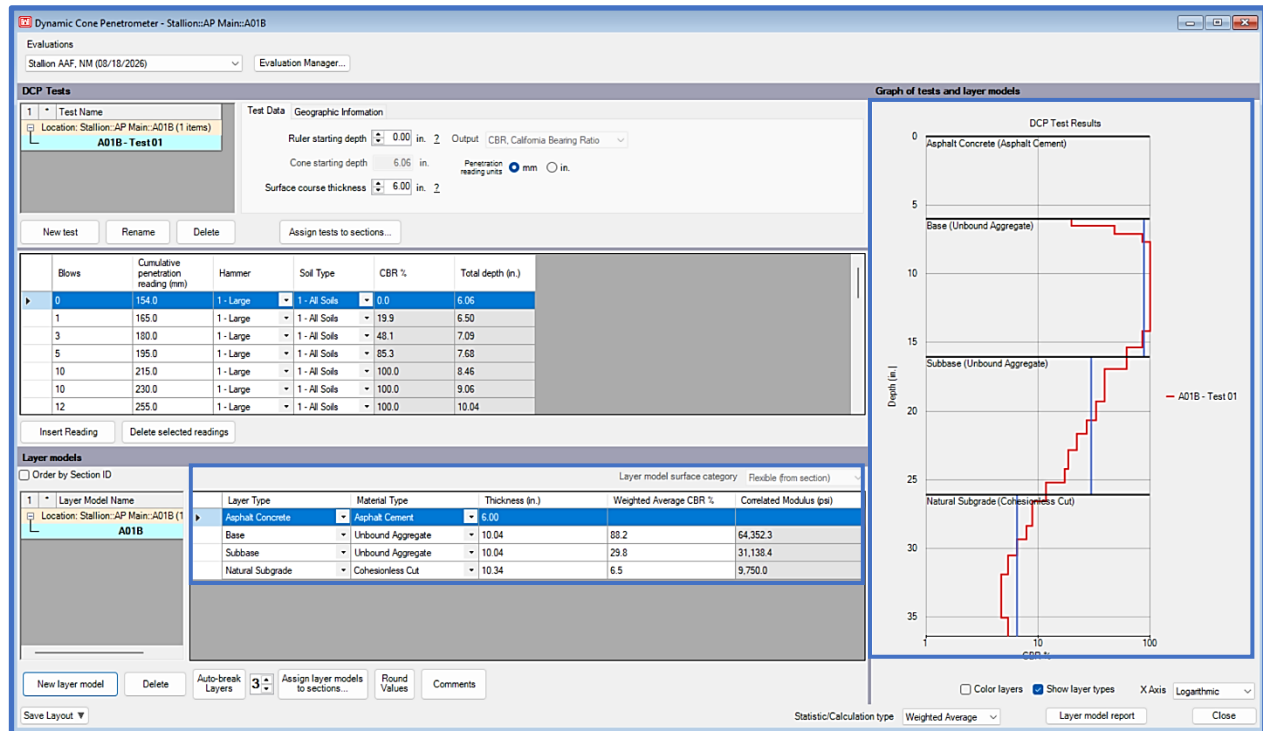
- Change the Surface course thickness to 6”



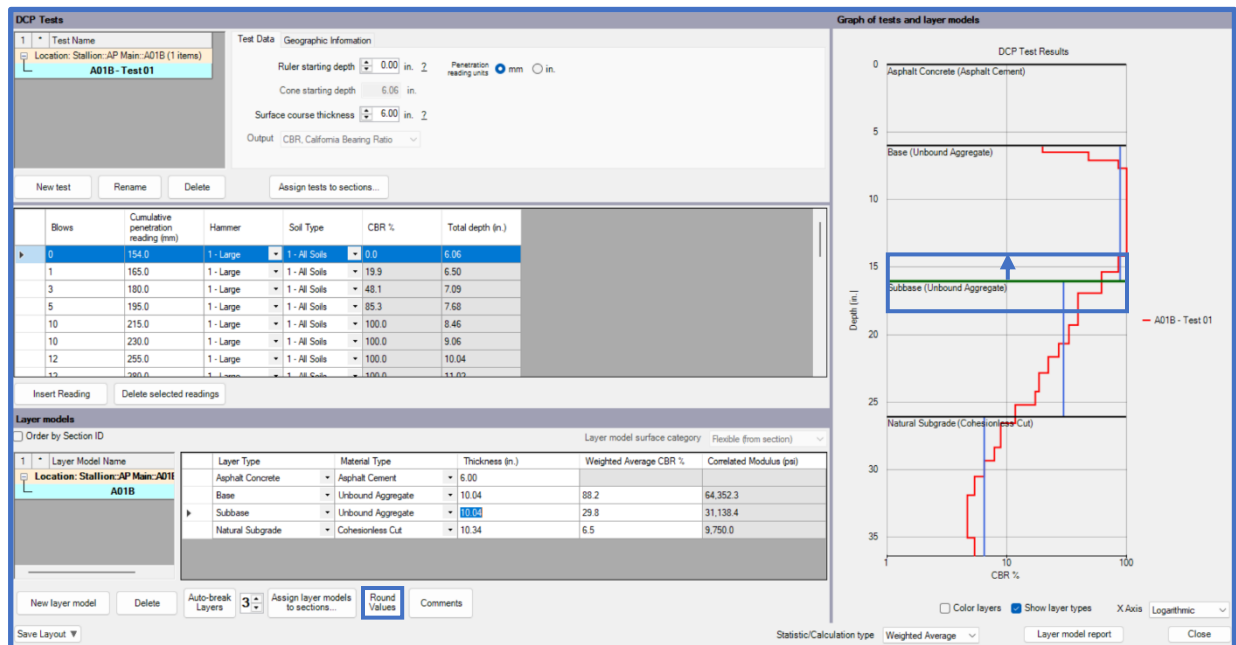
- Select New layer model on the DCP form and name it “A01B”
- Click OK



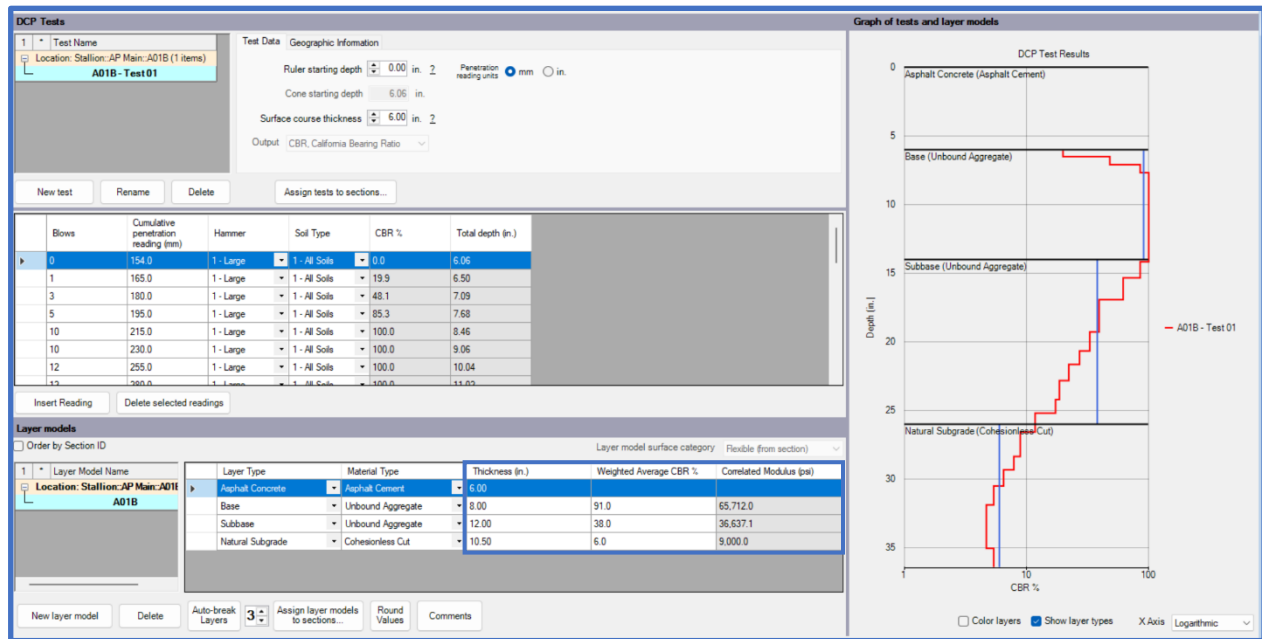
- A default layer model populates and is also visualized within the DCP Test Results graph



- Select the Subbase layer boundary line on the graph and drag it upwards to a depth of 8"
- The layer model grid reflects changes made within the graph
- Select Round Values

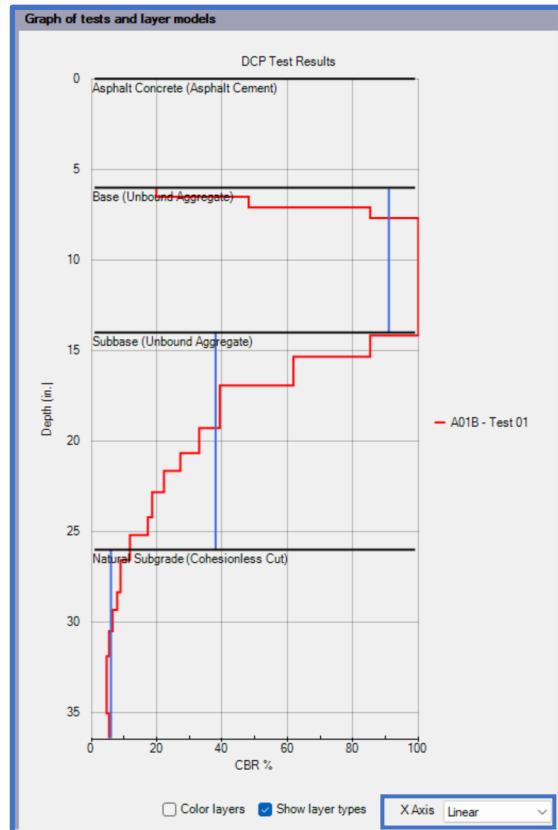
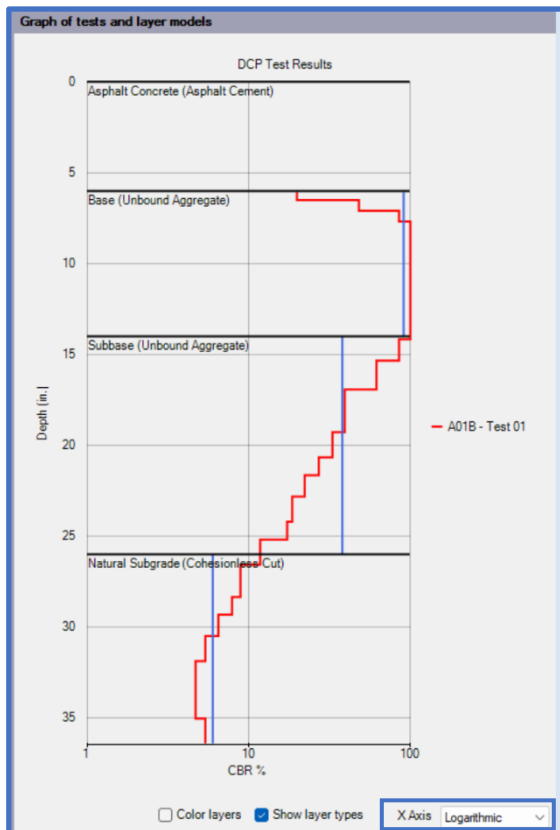


- The layer model grid values reflect the changes made on the graph



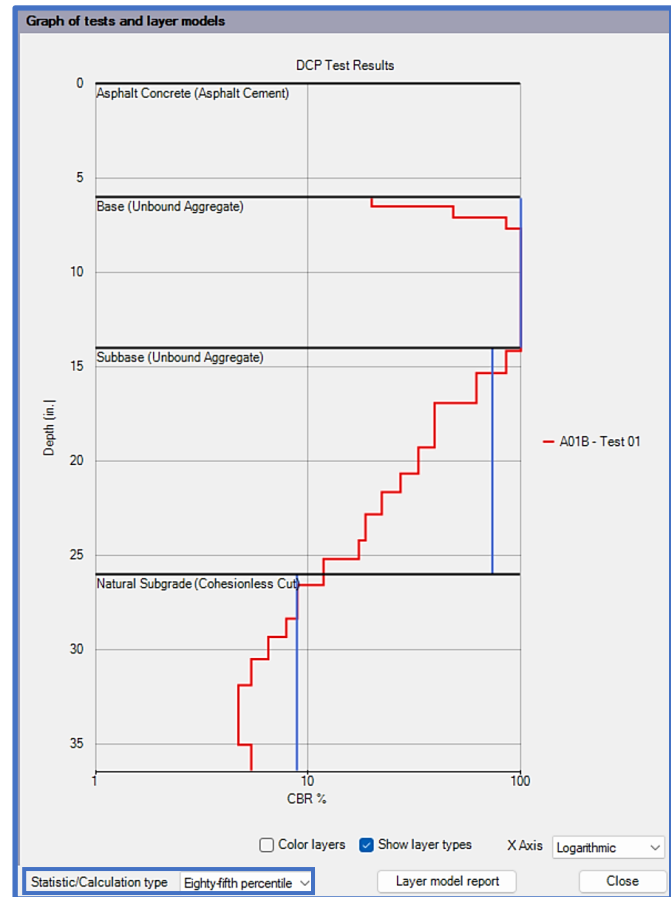
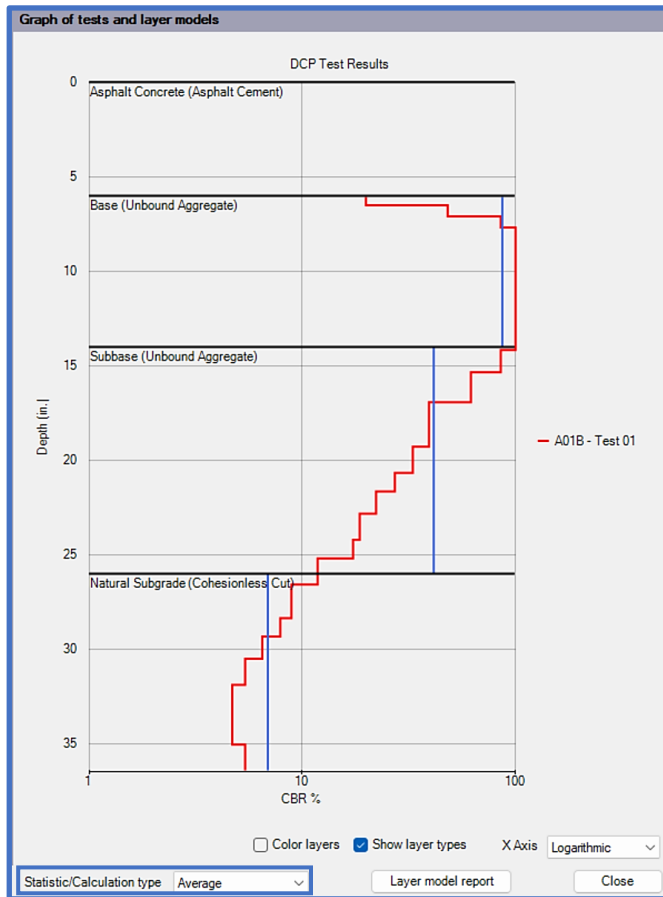
Step 5. X-Axis: Toggle between Logarithmic and Linear to view differences

- The DCP Test Results graph defaults to X-Axis: Logarithmic
- Select X-Axis: Linear



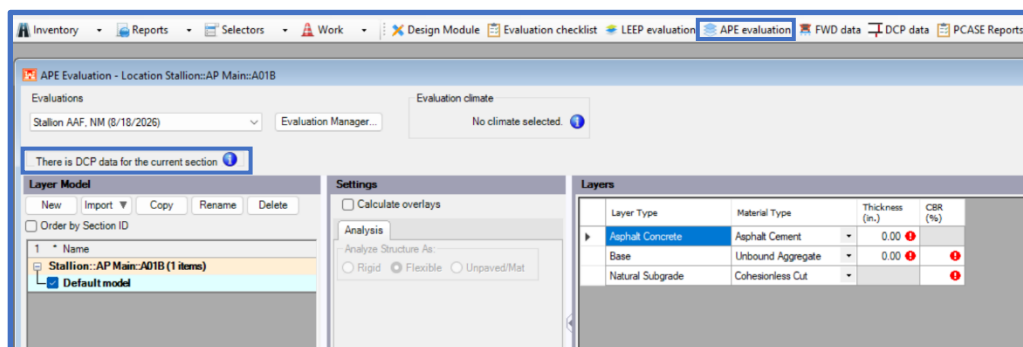
Step 6. Compare Statistic/Calculation type: Average and 85th percentile

- Select Statistic/Calculation type: Average from the drop-list
- Select Statistic/Calculation type: Eighty-fifth percentile from the drop-list

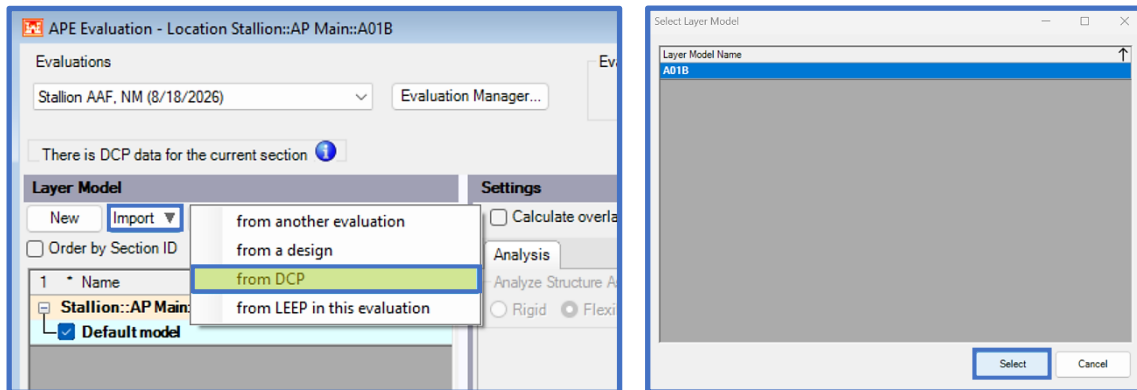


Step 7. Layer model import into APE evaluation

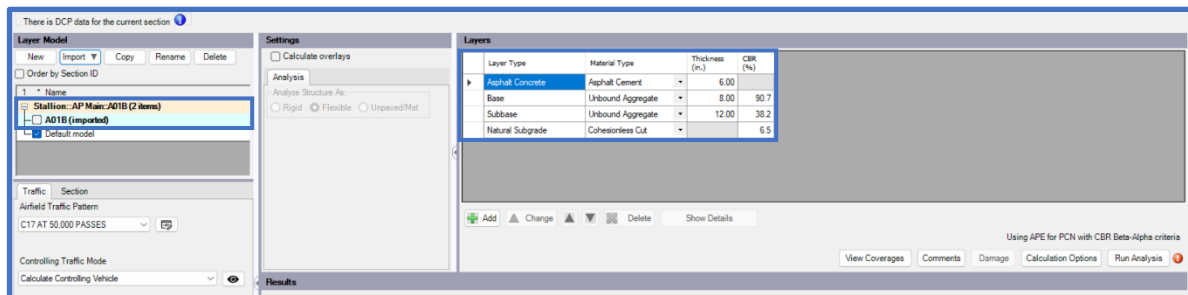
- Change the Statistic/Calculation type back to Weighted Average
- Close the DCP form
- Open APE evaluation from the toolbar, a notification message shows there is DCP data associated with the selected section



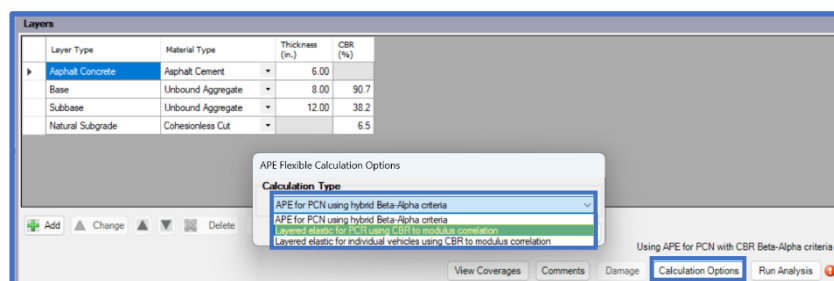
- Select **Import**, then **from DCP**
- Click on the **Select** button



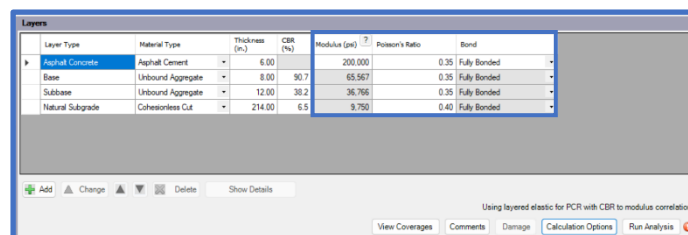
- The imported layer model populates with the layer properties that were defined in DCP



- Select **Layered elastic for PCR using CBR to modulus correlation** in **Calculation Options**
- Click **OK**



- Moduli, Poisson's Ratio and Bond values are added the structure



- Select Run Analysis
- Analysis results are displayed

APE Evaluation - Location Station: AP Main: A01B

Evaluations
Station AAF, NM (8/19/2026) Evaluation Manager... Evaluation climate
No climate selected

There is DCP data for the current section

Layer Model
New Import Copy Rename Delete
Order by Section ID

1 * Name
Station: AP Main: A01B (2 items)
A01B (imported)
Default model

Traffic Section
Airfield Traffic Pattern
C17 AT 50,000 PASSES

Layers

Layer Type	Material Type	Thickness (in.)	CBR (%)	Modulus (psi)	Poisson's Ratio	Bond	Controlling Layer (AGL)	Controlling Layer (AP)	Allowable Gross Load (lb)	Allowable Passes
Asphalt Concrete	Asphalt Cement	6.00		200,000	0.35	Fully Bonded	☐	☐	336,375	1,356,172
Base	Unbound Aggregate	8.00	90.7	65,567	0.35	Fully Bonded	☐	☐		
Subbase	Unbound Aggregate	12.00	38.2	36,766	0.35	Fully Bonded	☐	☐		
Natural Subgrade	Cohesionless Cut	214.00	6.5	9,750	0.40	Fully Bonded	☒	☒	408,672	1,575

Add Change Delete Show Details

Using layered elastic for PCR with CBR to modulus correlation

View Coverages Comments Damage Calculation Options Run Analysis

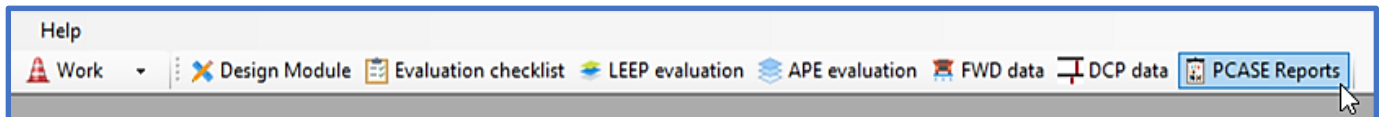
Results

Vehicle	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
C-17A GLOBEMASTER III	585,000	50,000	408,672	1,575	523	316	316 F/C W/O	1.7	Red

17 PCASE Reports

Evaluation reports can be accessed from several different locations within the program including PCASE Reports on the toolbar, Evaluation Checklist, LEEP evaluation, and APE evaluation.

Note: PCASE reports use excel templates without any classification markings based on the assumption that all data is unclassified, publicly releasable. If the information in the individual database in CUI, it is the user's responsibility to properly mark any reports generated by PCASE at the appropriate classification level. The user will add header and footer with the appropriate classification markings.



The PCASE Reports window consists of an Evaluations field which lists all evaluations in the currently open database. Selecting a report name from the list reveals which sections have the appropriate results for the selected report. After Run Report has been initialized, a directory window for File Explorer opens so that you may save the report. After the report has been saved, an Excel sheet opens and displays the report data.

A screenshot of the 'Evaluation Reports' window. It features a list of evaluations on the left, a central grid of sections and report items, and a 'Run Report' button at the bottom right. Two callout boxes provide additional information: one explains that sections with APE and/or LEEP results are displayed by default and can be omitted by unchecking a box; the other instructs the user to select a report category and click 'Run Report' to populate the selected report, noting that some reports are only enabled if specific section property criteria are met.

1 * Include

Section	Report Item
APE (10 items)	
☒ SilverFlag::AP Main::A01B	01
☒ SilverFlag::AP Main::A01B	01 - Contingency Traffic-PCR
☐ SilverFlag::RW0927::R02C	01
☐ SilverFlag::RW0927::R03A	01
☒ SilverFlag::RW0927::R03A	01 - Contingency Traffic-PCR
☐ SilverFlag::RW1331::R04A	01
☒ SilverFlag::TWA::T01A	01
☒ SilverFlag::TWA::T01A	01 - PCR
☐ SilverFlag::TWB::T02C	Default model-Flex
☐ SilverFlag::TWC::T03A	01
LEEP (3 items)	

Select All Select None Run Report Close

All sections with APE and/or LEEP results are displayed in the grid and selected by default. To omit sections from a report, uncheck the box to the left of a section name prior to running the report. The form remembers section selections after running a report, so you can toggle different reports without losing your selections.

Select a report category, then click on the Run Report button to populate the selected report. *Note: Some reports are only enabled if the data contains specific section property criteria; see the report descriptions in this chapter for more information.*

17.1 Evaluation Checklist

The **Evaluation Checklist** report is enabled for evaluations that contain an inventory within the current database. The report provides a status summary of the pavement inventory and associated section property data for the selected evaluation.

Evaluation Checklist									
Inspection Date: 3/19/2020									
PCASE Development Build									
Section	Layer Model	Pavement Type	Evaluation Type	Active Structure	Traffic Assigned	Has Layers	Has NDT	Has Results	
MCASCP::APADA::A59B	01	Rigid	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APCALA::A47B	01	Rigid	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APCCA::A58B	01	Rigid	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APCCA::A51B	01	Flexible	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APCCA::A52B	01	Flexible	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APRF::A57B	01	Flexible	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::APTOW::A53B	01	Flexible	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::HP1VTL::H01A	01	Rigid	LEEP	Yes	Yes	Yes	Yes	Yes	
MCASCP::HP1VTL::H02A	01	Rigid	LEEP	Yes	Yes	Yes	Yes	Yes	

17.2 Evaluation Results (ACN-PCN) or (ACR-PCR)

If LEEP and/or APE evaluation results exist in the currently open database; the Evaluation Results report displays the layer model and analysis results for each section. LEEP and APE results are separated by individual tabs on the spreadsheet. There are two versions of the report which correlate with the calculation option used for an analysis. The first example shown below is for PCN analysis.

A	B	C	D	E	F	G	H	I	J	K	L	M
APE Results Report												
Inspection Date: 8/24/2026												
PCASE 7.0.8 Engineering Release 2026-09-21												
Section: SilverFlag-AP Main-A01B		Layer Model: 01										
		Traffic Area:		Area B								
		Condition:		100								
		Subgrade CBR/K:		175								
		Rigid Failure Criteria:		Shattered Slab								
		Overlay Flex Strength:		650								
		Joint Defl. Ratio:		0.76								
		SCI:		0								
		Cb:		0.8								
		Cr:		0.75								
Layer Information												
Layer Type		Material	Thickness (in)	K (pci)	Computed Eff. K (pci)	Flex Strength	Modulus (psi)	Poisson's Ratio	Controlling Layer			
PCC Partially Bonded Overlay		Portland Cement	8	8			700	5000000	0.15			
Portland Cement Concrete		Portland Cement	10	10			700	5000000	0.15			
Natural Subgrade		Cohesionless Cut		175	175				X			
Evaluation Results												
Vehicle		Load	Passes	ACN	PCN String	AGL (lb)	Allowable Passes	AC Overlay Thickness (in)	PCC Partially Bonded Overlay Thickness	PCC Unbonded Overlay Thickness	PCC Fully Bonded Overlay Thickness	
C-17A GLOBEMASTER III			585000	50000	54 56/R/C/W/T	600432	65084	0	0	0	0	

The next example displays the ACR-PCR version of the Evaluation Results report. The Calculation Option, selected vehicle for reportable PCR (if applicable), and Reportable PCR are published along with ACR-PCR results.

A		B		C		D		E		F		G		H		I		J	
Section: SilverFlag_AP Main: A21B		Layer Model: 01																	
		Traffic Area:		Area B															
		Condition:		100															
		Failure SCI:		0															
		Joint Defl. Ratio:		0.76															
		SCI:		0															
		Cb:		0.8															
		Cr:		0.75															
		Calculation Option:				Use LEAGL for individual vehicles													
		Reportable PCR Based On:				C-130J HERCULES													
		Layer Information																	
		Layer Type		Material		Thickness (in)		Flex Strength		Modulus (psi)		Poisson's Ratio		Bond					
		Portland Cement Concrete		Portland Cement		6		700		10000000		0.15		Partially Bonded					
		Base		Unbound Aggregate		8				150000		0.35		Fully Bonded					
		Natural Subgrade		Cohesionless Cut		226				14123		0.4		Fully Bonded					
		Bedrock		Bedrock						1000000		0.5							
		Evaluation Results																	
		Vehicle		Load		Passes		AGL (lb)		Allowable Passes		ACR		PCR		Reportable PCR		ACR/PCR	
		C-130J HERCULES				175000		100		172051		95		399		391			
		C-130J HERCULES				195000		100		172051		137		346		391		0.9	
		C-130J HERCULES				135000		100		172051		217		293		391		0.7	
		C-17A GLOBEMASTER III				585000		50000		135920		9		621		98		1.6	
		C-17A GLOBEMASTER III				500000		100		285377		14		491		232		1.3	
		C-17A GLOBEMASTER III				450000		100		285377		19		422		232		1.1	
		C-5A/B GALAXY				840000		100		544007		19		500		244		1.3	
		E-3 SENTRY AVIAC				325000		100		259562		49		553		397		1.4	
		F-15D EAGLE				68000		100		81228		172		293		350		0.7	
		KC-10A REFUELER				590000		100		338550		24		754		340		1.9	
		KC-135R/T STRATOTANKER				322500		100		275341		60		501		397		1.3	
		MV-22 OSPREY				60500		100		124884		4778		134		320		0.3	

17.3 Mixed Traffic AGL-PCN Report

The **Mixed Traffic AGL-PCN Report Normal Period** option is only available for airfield sections that have APE and/or LEEP evaluation results, and must use a **Mixed Traffic Analysis Type** or a 14 Groups traffic pattern. If a 14 Groups traffic pattern is used for a section, the report will output a single row for the Group 10 vehicle at 585 kips and 50,000 passes. When this report is selected, an option to include both English and Metric values in the report populates at the bottom of the report window.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Mixed Traffic AGL-PCN Report																
2	Inspection Date: 3/19/2020																
3	PCASE Development Build																
4																	
5	Pavement Facility		Section	Test Number or Station, ft	Design Aircraft				Allowable Gross Load, kips	PCN	Theoretical Overlay						
Aircraft					Weight, kips	Passes	ACN	AC			PC C No	PC C Part					
10	HP2VTL		H03A	-	P-8A POSEIDON	188	27	59/R/B/W/T	529	177/R/B/W/T	-	-	-				
11			H04A	-	P-8A POSEIDON	188	86	59/R/B/W/T	310	101/R/B/W/T	-	-	-				
12	HP3VTL		H05A	-	P-8A POSEIDON	188	27	59/R/B/W/T	277	90/R/B/W/T	-	-	-				
13			H06A	-	P-8A POSEIDON	188	27	59/R/B/W/T	280	91/R/B/W/T	-	-	-				
14	APADA		A59B	-	P-8A POSEIDON	188	86	59/R/B/W/T	270	87/R/B/W/T	-	-	-				
15	HP1VTL		H01A	-	P-8A POSEIDON	188	27	59/R/B/W/T	2,161	746/R/B/W/T	-	-	-				
16			H02A	-	P-8A POSEIDON	188	27	59/R/B/W/T	296	96/R/B/W/T	-	-	-				
17	HP4VTL		H07A	-	P-8A POSEIDON	188	41	59/R/B/W/T	708	240/R/B/W/T	-	-	-				
18			H08A	-	P-8A POSEIDON	188	41	59/R/B/W/T	296	96/R/B/W/T	-	-	-				
19	TWE		T06A	-	P-8A POSEIDON	188	191	51/F/B/W/T	281	80/F/B/W/T	-	-	-				
20	TWF		T07A	-	P-8A POSEIDON	188	267	48/F/A/W/T	335	90/F/A/W/T	-	-	-				
21			T08A	-	P-8A POSEIDON	188	191	51/F/B/W/T	184	50/F/B/W/T	-	-	-				
22			T09A	-	P-8A POSEIDON	188	191	51/F/B/W/T	234	65/F/B/W/T	-	-	-				
23			T10A	-	P-8A POSEIDON	188	267	48/F/A/W/T	365	98/F/A/W/T	-	-	-				
24			T11A	-	P-8A POSEIDON	188	191	51/F/B/W/T	187	51/F/B/W/T	-	-	-				
25	TWJ		T20A	-	P-8A POSEIDON	188	4,674	48/F/A/W/T	451	123/F/A/W/T	-	-	-				
26	TWK		T24A	-	P-8A POSEIDON	188	46	51/F/B/W/T	366	106/F/B/W/T	-	-	-				
27			T25A	-	P-8A POSEIDON	188	46	51/F/B/W/T	285	81/F/B/W/T	-	-	-				
28	TWP		T40A	-	P-8A POSEIDON	188	191	51/F/B/W/T	198	54/F/B/W/T	-	-	-				
29	TW2VTL		T41A	-	P-8A POSEIDON	188	46	51/F/B/W/T	331	95/F/B/W/T	-	-	-				
30	TW3VTL		T42A	-	P-8A POSEIDON	188	65	48/F/A/W/T	469	128/F/A/W/T	-	-	-				
31	TWAWA		T43A	-	P-8A POSEIDON	188	191	51/F/B/W/T	202	55/F/B/W/T	-	-	-				
32	RW14L		R05A	-	P-8A POSEIDON	188	3,317	48/F/A/W/T	518	142/F/A/W/T	-	-	-				
33	APCALA		A47B	-	P-8A POSEIDON	188	904	59/R/B/W/T	195	61/R/B/W/T	-	-	-				
34			A51B	-	P-8A POSEIDON	188	191	51/F/B/W/T	240	67/F/B/W/T	-	-	-				
35	APCCA		A52B	-	P-8A POSEIDON	188	191	51/F/B/W/T	265	75/F/B/W/T	-	-	-				

The **Mixed Traffic AGL-PCN Report Thaw-Weakened Period** option is only available for airfield sections that have APE and/or LEEP evaluation results with evidence of frost, and must use a **Mixed Traffic Analysis Type** or a 14 Groups traffic pattern. If a 14 Groups traffic pattern is used for a section, the report will output a single row for the Group 10 vehicle at 585 kips, and passes are split between the normal period and thaw-weakened period. When this report is selected, an option to include both English and Metric values in the report populates at the bottom of the report window.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Mixed Traffic AGL-PCN Report																
2	Inspection Date: 2/16/2023																
3	PCASE Development Build																
4																	
5	Pavement Facility			Section	Test Number or Station, ft	Design Aircraft				Allowa ble Gross Load, kips	PCN		Theoretical Overlay				
Aircraft						Weight , kips	Passes	ACN	AC				PC C No	PC C Par			
6	RW 01-19 Turnaround			A02B	0+00-2+60	*-GROUP10	585	16.667	54/R/C/W/T	421	36/R/C/W/T		-	-			

17.4 Army AGL-PCR Report

The Army AGL-PCR Report is available for sections that have PCR calculation results. The Reportable PCR (vehicle with the largest PCR) and analysis results are displayed for each section. Both normal period (no evidence of frost damage) and thaw-weakened period (with evidence of frost damage) versions of the report are available.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Army AGL-PCR Report Normal Period																
2	Inspection Date: 2/19/2026																
3	PCASE 7.0.8 Engineering Release 2026-09-21																
4																	
5	Pavement Facility	Section	Test Number or Station, ft	Design Aircraft				Allowable Gross Load, kips	PCR	Theoretical Overlay Requirements, in							
6				Aircraft	Weight, kips	Passes	ACR			AC	PCC No Bond	PCC Partial Bond					
7																	
8																	
9	UNKNOWN	T01A		C-17A GLOBEMASTER III	585	50,000	547/R/B/W/T	498	437/R/B/W/O	-	-	-					
10	UNKNOWN	T02A		C-17A GLOBEMASTER III	585	37,500	523/F/C/W/T	199	136/F/C/W/O	-	-	-					
11																	

Results											
	Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
▶	C-17A GLOBEMASTER III	Normal (Jul-Mar)	585,000	37,500	198,633	41	523	136	136/F/C/W/O	3.8	Red
	C-17A GLOBEMASTER III	Thaw-Weakened (Apr...	585,000	12,500	198,633	14	704	148	148/F/D/W/O	4.8	Red

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Army AGL-PCR Report Thaw-Weakened Period																
2	Inspection Date: 2/19/2026																
3	PCASE 7.0.8 Engineering Release 2026-09-21																
4																	
5	Pavement Facility	Section	Test Number or Station, ft	Design Aircraft				Allowable Gross Load, kips	PCR	Theoretical Overlay Requirements, in							
6				Aircraft	Weight, kips	Passes	ACR			AC	PCC No Bond	PCC Partial Bond					
7	UNKNOWN	T02A		C-17A GLOBEMASTER III	585	12,500	704/F/D/W/T	199	148/F/D/W/O	-	-	-					

17.5 ISR Report (ACN-PCN) or (ACR-PCR)

The **ISR Report** generates a spreadsheet with section PCI, ACN/PCN ratio or ACR/PCR ratio, ISR rating, and work recommendations for evaluated sections. This report applies to both non-frost and frost evaluations. The Combined Rating column is driven by the lower of either the PCI or the ACN/PCN column values, the rules are as follows:

Red ISR Rating	0 < PCI ≤ 55	or	Red ISR Rating	ACN/PCN > 1.4
Amber ISR Rating	55 < PCI ≤ 70		Amber ISR Rating	1.1 < ACN/PCN ≤ 1.4
Green ISR Rating	70 < PCI ≤ 100		Green ISR Rating	ACN/PCN ≤ 1.1

The report's Work Classification columns are based on the following rules:

Reconstruction	PCI ≤ 25
Major repair	PCI > 25 and ≤ 40
Localized repair with medium and high-severity distress	PCI > 40
Do nothing with low-severity distress	PCI > 40

Mixed traffic analysis is a section requirement for the ACN-PCN version of the **ISR report**.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	ISR Report													
2	Inspection Date: 8/5/2026													
3	PCASE 7.0.8 Engineering Release 2026-09-21													
4	Branch	Section	ISR			Combined Rating	Work Classification							
5			PCI	ACN/PCN	Critical Aircraft		Do Nothing	Localized M&R	Major M&R	Reconstruction				
6	UNKNOWN	A01B	100	1.0	C-17A GLOBEMASTER III	Green	X							
7	Critical Aircraft is defined in Appendix D.													

A PCR calculation option must be used for an analysis to execute the **ISR Report (ACR-PCR)** for a section.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	ISR Report (ACR-PCR)													
2	Inspection Date: 8/6/2026													
3	PCASE 7.0.8 Engineering Release 2026-09-21													
4	Branch	Section	ISR			Combined Rating	Work Classification							
5			PCI	ACR/PCR	Critical Aircraft		Do Nothing	Localized M&R	Major M&R	Reconstruction				
6	UNKNOWN	R01A	40	0.6	C-130H Hercules	Red			X					
7	UNKNOWN	T01A	40	0.8	C-130H Hercules	Red			X					
8	UNKNOWN	A01B	40	0.3	C-130H Hercules	Red			X					
9	Critical Aircraft is defined in Appendix D.													

17.6 14-Group AGL Report

Sections with LEEP and/or APE analysis results using a 14 Groups traffic pattern are displayed when the 14-Group AGL Normal Period report is selected. This report displays a summary of non-frost Allowable Gross Loads for 14 Groups at 4 pass intensity levels.

Red	AGL < lightest aircraft in group
Yellow	AGL ≥ lightest and < heaviest aircraft
Green	AGL ≤ heaviest aircraft

SUMMARY OF ALLOWABLE GROSS LOADS															
Normal Period															
PCASE 7.0.8 Engineering Release 2026-09-21															
PAVEMENT CAPACITY IN KIPS FOR AIRCRAFT GROUP INDEX NUMBERS															
SECTION NAME	PASS INTENSITY LEVEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A01B	I	103	97	149	261	141	157	148	321	359	600	937	498	707	275
	II	120	117	173	304	161	180	170	369	412	681	1065	573	809	330
	III	136	135	195	377	195	221	210	454	511	822	1286	716	998	425
	IV	163	168	231	492	251	287	281	601	686	1046	1633	970	1330	566
R03A	I	88	79	128	221	116	131	123	292	328	586	882	448	649	244
	II	103	96	150	259	133	150	141	334	378	677	1010	519	748	296
	III	116	111	168	326	163	186	173	419	473	835	1241	651	932	386
	IV	140	140	200	429	211	243	231	551	639	1078	1599	895	1259	521
R05A	I	101	93	149	277	139	158	147	361	408	727	1078	560	805	296
	II	120	115	176	325	160	183	171	421	479	853	1250	662	945	369
	III	136	136	199	409	198	229	217	534	617	1071	1544	865	1213	500
	IV	166	173	240	545	262	305	303	730	870	1409	2011	1240	1736	713
R06A	I	151	155	222	441	218	254	247	576	667	1159	1736	947	1325	491
	II	179	189	261	506	249	291	289	668	786	1319	1973	1126	1570	620
	III	205	219	295	622	306	357	368	834	1000	1593	2380	1448	2038	849
	IV	253	273	357	825	404	470	500	1110	1350	2035	3038	1974	2820	1178
R07A	I	116	110	177	353	167	194	181	481	547	918	1356	755	1065	372
	II	138	139	210	414	193	228	215	572	660	1081	1578	917	1288	478
	III	159	165	239	522	242	287	283	734	874	1353	1959	1250	1734	682
	IV	199	212	292	710	328	389	406	1012	1238	1786	2566	1800	2563	1007
T02C	I	151	151	209	332	192	242	217	511	543	810	1493	683	1062	365
	II	173	175	239	374	215	270	240	566	603	898	1644	758	1174	427
	III	194	197	265	450	255	318	283	666	710	1057	1907	894	1376	531
	IV	231	237	311	571	322	400	355	832	893	1317	2319	1128	1714	683

Sections with LEEP and/or APE analysis results with evidence of frost damage, using a 14-Groups traffic pattern for analysis, are displayed when the 14-Group AGL Thaw-Weakened Period report is selected. The frost Allowable Gross Loads for 14 Groups at 4 pass intensity levels are displayed in this version of the report.

SUMMARY OF ALLOWABLE GROSS LOADS															
Thaw-Weakened Period															
PCASE Development Build															
PAVEMENT CAPACITY IN KIPS FOR AIRCRAFT GROUP INDEX NUMBERS															
SECTION NAME	PASS INTENSITY LEVEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A02B	I	93	89	117	188	116	133	128	268	299	406	670	399	583	218
	II	110	107	137	220	132	152	146	306	342	459	756	458	664	259
	III	126	124	155	279	162	186	180	378	423	557	908	569	815	331
	IV	154	156	188	382	214	244	236	506	571	724	1167	771	1086	439
A03B	I	125	123	181	348	166	213	204	539	561	719	1366	721	1055	371
	II	148	150	212	404	190	241	235	629	663	833	1558	859	1239	456
	III	168	174	239	501	232	293	288	787	855	1032	1881	1132	1606	607
	IV	205	217	288	665	305	382	381	1045	1170	1342	2381	1594	2273	836
A04B	I	172	181	272	577	242	328	328	949	1020	1297	2415	1373	1955	653
	II	203	217	318	656	275	370	375	1083	1184	1470	2702	1622	2335	820
	III	230	249	358	798	334	447	459	1316	1461	1761	3191	2030	2964	1082
	IV	281	307	432	1045	436	580	599	1704	1909	2214	3965	2670	3930	1432
A05B	I	109	104	151	280	141	175	166	443	479	589	1153	618	908	311
	II	128	127	177	329	161	200	192	516	562	679	1320	730	1059	379
	III	146	148	200	414	197	243	237	650	725	843	1607	953	1353	497
	IV	179	186	241	555	260	318	312	874	1007	1113	2054	1384	1916	683
O01C	I	155	160	196	350	194	225	224	468	558	835	1540	752	1122	537
	II	175	183	223	383	212	245	245	510	612	916	1684	826	1229	607
	III	191	199	242	432	237	275	276	573	691	1035	1895	937	1390	712
	IV	221	231	281	521	261	311	311	661	781	1081	1981	1031	1481	761

17.7 14-Group PCN Report

Only sections with LEEP and/or APE analysis results using a 14-Groups traffic pattern are displayed when the 14-Group PCN Normal Period report is selected. This report contains a summary of non-frost PCN results for each section in the selected evaluation; based on Group 10 pass intensity level 1 (50,000 passes of a C-17A).

	A	B	C	D	E	F	G	H
1	PAVEMENT CLASSIFICATION NUMBER							
2	Normal Period							
3	PCASE Development Build							
4	SECTION	PCN	SECTION	PCN	SECTION	PCN	SECTION	PCN
5	A01B	44/R/C/W/T						
6	A02B	41/R/C/W/T						
7	A03B	28/R/C/W/T						
8	A04C	34/R/D/W/T						
9	A05B	48/R/C/W/T						
10	A06B	38/R/C/W/T						
11	A07C	34/R/C/W/T						
12	A08C	29/R/D/W/T						
13	A09C	41/R/D/W/T						
14	T01A	23/R/D/W/T						
15	T02A	36/R/C/W/T						

Sections with LEEP and/or APE analysis results with evidence of frost damage, using a 14 Groups traffic pattern are available for selection for the 14-Group PCN Thaw-Weakened Period report. The PCN string for the thaw-weakened period is displayed for each section.

	A	B	C	D	E	F	G	H
1	PAVEMENT CLASSIFICATION NUMBER							
2	Thaw Weakened Period							
3	PCASE Development Build							
4	SECTION	PCN	SECTION	PCN	SECTION	PCN	SECTION	PCN
5	A01B	39/R/A/W/T						
6	A02B	36/F/A/W/T						
7	A03B	53/R/A/W/T						
8	A04B	98/R/A/W/T						
9	A05B	47/R/B/W/T						
10	O01C	69/F/B/W/T						

17.8 Section PCR Report

The Section PCR Report displays the Reportable PCR string results for each section that has been analyzed using a PCR calculation option. Both a normal period and thaw-weakened period (with climate station data and evidence of frost damage) version of the report are available.

	A	B	C	D	E	F	G	H
1	PAVEMENT CLASSIFICATION RATING							
2	Normal Period							
3	PCASE 7.0.8 Engineering Release 2026-09-21							
4	SECTION	PCR	SECTION	PCR	SECTION	PCR	SECTION	PCR
5	T01A	437/R/B/W/O						
6	T02A	136/F/C/W/O						

Results											
	Vehicle	Analysis Period	Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACR	PCR	Reportable PCR	ACR/PCR	ACR/PCR Rating
▶	C-17A GLOBEMASTER III	Normal (Jul-Mar)	585,000	37,500	198,633	41	523	136	136/F/C/W/O	3.8	Red
	C-17A GLOBEMASTER III	Thaw-Weakened (Ap...	585,000	12,500	198,633	14	704	148	148/F/D/W/O	4.8	Red

	A	B	C	D	E	F	G	H
1	PAVEMENT CLASSIFICATION RATING							
2	Thaw Weakened Period							
3	PCASE 7.0.8 Engineering Release 2026-09-21							
4	SECTION	PCR	SECTION	PCR	SECTION	PCR	SECTION	PCR
5	T02A	148/F/D/W/O						

17.9 Hybrid Traffic

Sections that used the Hybrid Traffic analysis type in an APE or LEEP analysis (PCN analysis only) are available for selection within the report window when the Hybrid Traffic report is selected. The report consists of three tabs; Controlling Results, Tentative Results, and Projected Traffic.

The screenshot shows a window titled "Traffic" with a sub-header "Patterns in Selected Project" containing the text "P12 FB AS & IMF". Below this are buttons for "Create", "Delete", "Rename", "Copy", "Import", and "Standard". A dropdown menu labeled "Traffic Analysis Type" is set to "Hybrid".

The Controlling Results are derived from the APE/LEEP form's Controlling Vehicle for Report field selection, choose the controlling aircraft and associated results to publish in the report.

Results

C-130H Hercules C-17A GLOBEMASTER III F-35C JOINT STRIKE FIGHTER CV KC-135 REFUELER P-8A POSEIDON		Evaluation Load (lb)	Evaluation Passes	AGL (lb)	Allowable Passes	ACN	PCN	PCN String	ACN/PCN	ACN/PCN Rating	AC Overlay (in.)	PCC Nonbonded (in.)
	▶	188,200	148	243,405	762	59	78	78/R/B/W/T	0.8	Green	0.0	0.0
		188,200	99	262,504	762	59	85	85/R/B/W/T	0.7	Green	0.0	0.0
		188,200	74	277,979	762	59	90	90/R/B/W/T	0.7	Green	0.0	0.0
		188,200	50	303,169	762	59	99	99/R/B/W/T	0.6	Green	0.0	0.0
<												

Controlling Vehicle for Report: P-8A POSEIDON

If a controlling vehicle was not selected for a section, "NONE SELECTED" is displayed in the Controlling Aircraft field. Below is an example of the controlling aircraft results tab.

Controlling Aircraft Results																
Inspection Date: 3/19/2020 12:00:00 AM PCASE Development Build																
Identification					Pattern Info.			Results						Theoretical Overlay Requirements (in.)		
Branch ID	Section ID	Pave. Type	Last PCI	Last SCI	Pattern ID	Controlling Aircraft	Pass Intensity Factor	ACN	PCN	ACN/PCN Ratio	Allowable Gross Load (kips)	Equivalent Evaluation Passes	Allowable Passes	AC	PCC Non-bond	PCC Partial Bond
APADA	A59B	PCC	100	50	P12 RB AS & IMF	P-8A POSEIDON	1	58.9	85/R/B/W/T	0.7	283	99	762	0.0	0.0	0.0

The Tentative Results tab summarizes the representative aircraft results for each vehicle in the traffic pattern, using the specified Pass Intensity Factors.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1																						
2																						
3																						
4	Identification					Pattern Info.		C-17A GLOBEMASTER III														
5								Representative Aircraft Results														
6	Branch ID	Section ID	Pave. Type	Last PCI	Last SCI	Pattern ID	Pass Intensity Factor	ACN	PCN	ACN/PCN Ratio	Allowable Gross Load kips	Equivalent Evaluation Passes	Allowable Passes	Theoretical Overlay Requirements (Inch)								
7														AC	PCC Non-Bond	PCC Partial-bond						
8																						
9																						
10	APADA	A59B	PCC	100	50	RB AS &	1.5	46.7	50/R/B/W/T	0.9	618	387	602	0.0	0.0	0.0						
11							1	46.7	53/R/B/W/T	0.9	653	258	602	0.0	0.0	0.0						
12							0.75	46.7	55/R/B/W/T	0.9	679	194	602	0.0	0.0	0.0						
13							0.5	46.7	58/R/B/W/T	0.8	721	129	602	0.0	0.0	0.0						

Projected Traffic displays the vehicle information for each traffic pattern used in the hybrid analysis.

	A	B	C	D	E	F	G	H	I
1	Projected Mixed Traffic								
2	Inspection Date: 3/19/2020 12:00:00 AM								
3	PCASE Development Build								
4	Pattern ID	Aircraft			Gear Type	Weight (lbs)			Passes
5						Maximum	Operationa	Empty	
6		A-6 INTRUDER				60,421	60,421	26,600	1,288
7		E-2D ADVANCED HAWKEYE (AFLOAT)				57,500	57,500	44,375	633
8		F-35B JOINT STRIKE FIGHTER STOVL				61,500	61,500	32,283	3,780
9		F-35C JOINT STRIKE FIGHTER CV				70,400	70,400	35,174	676
10	P12 RB AS & IMF: MCASCP::APADA::A59 B	FA-18F				66,000	66,000	30,000	1,858
11		P-8A POSEIDON				188,200	188,200	98,495	1

17.10 Backcalculation Results

The **Backcalculation Results** report can be selected for sections that are associated with backcalculation results (have a representative basin). The detailed basin results data and associated layer structure are displayed.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	Backcalculation Results Report															
	Inspection Date: 9/19/2018															
	PCASE Development Build															
	Section: MCENTIRE::APRON: A01B															
	Layer Model: 01															
	Layer Information															
	Layer Type	Material	Thickness (in)	Seed (psi)	Min (psi)	Max (psi)	Poisson's Ratio	Bond								
	Portland Cement Concrete	Portland Cement	12.5	5000000	2500000	10000000	0.15	Partially Bonded								
	Base	Unbound Aggregate	23	40000	5000	150000	0.35	Fully Bonded								
	Natural Subgrade	Cohesive Cut	204.5	27307	22307	32307	0.4									
	Station Information															
	Station	Drop	Load (lb)	E1 (psi)	E2 (psi)	E3 (psi)	Deflection	Basin RMSE	D1 (mil)	D2 (mil)	D3 (mil)	D4 (mil)	D5 (mil)	D6 (mil)	D7 (mil)	
		234	3	61761	4148303	40000	29924 Measured		16.51	14.59	13.07	10.72	8.47	6.76	5.7	
							Computed	2.1%	16.7	14.7	12.6	10.5	8.6	7	5.6	
		235	3	61871	4053896	40000	33484 Measured		15.78	13.9	12.5	10.13	8.02	6.33	4.95	
							Computed	2.1%	16.1	14	11.9	9.9	8	6.4	5.1	
		236	3	62122	3870003	40000	30706 Measured		16.55	14.75	13.5	11.11	8.82	6.8	5.09	
							Computed	3.9%	17.1	14.9	12.7	10.6	8.6	6.9	5.5	
		237	3	60907	3355688	40000	21649 Measured		20.39	18.2	16.56	13.7	11.05	8.87	7.08	
							Computed	2.1%	20.8	18.3	15.8	13.4	11	9	7.3	
		240	3	61706	3586290	40000	33114 Measured		16.6	14.49	12.98	10.58	8.33	6.46	4.8	
							Computed	3.0%	17	14.7	12.4	10.2	8.2	6.5	5.1	
	Representative basin is Station 236, Drop 3															

17.11 Modulus Tables

The **Modulus Tables** report can be run for LEEP evaluation sections that have assigned backcalculation data and analysis results. The moduli for each layer are displayed in this report.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Layered Elastic Model Data														
2	Inspection Date: 10/9/2017														
3	PCASE Development Build														
4	Section	Layer 1				Layer 2				Layer 3				Layer 4	
5		Thickness (in)	Type	Modulus (psi)	Flex. Str. (psi)	Thickness (in)	Type	Modulus (psi)	Flex. Str. (psi)	Thickness (in)	Type	Modulus (psi)	Thickness (in)	Type	Modulus (psi)
6	A01B	12.50	PCC	1,014,980	700	15.00	BASE	1,000		22.00	SBASE	10,000,000	197.50	CSUBG	10,000,000
7	A02B	12.50	PCC	5,000,000	700	15.00	BASE	32,000		22.00	SBASE	5,000	190.50	CSUBG	21,959
8	A03B	12.00	PCC	1,519,542	700	20.00	BASE	61,000		30.00	SBASE	24,000	196.00	CSUBG	11,681
9	A04B	12.50	PCC	388,565	700	33.00	BASE	32,000		45.00	SBASE	5,000	200.50	CSUBG	9,174
10	A05B	12.00	PCC	788,810	700	28.00	BASE	5,258					206.00	CSUBG	14,126
11	O02C	12.00	PCC	438,473	700	15.00	BASE	2,040		30.00	SBASE	45,000	228.00	CSUBG	28,124

The Modulus Tables report also has a Backcalculation Settings tab which displays the Backcalculation Method that was used for each section in the report and whether or not a bedrock layer was present within the structure.

	A	B	C
1	Backcalculation Parameter Settings		
2	Inspection Date: 2/19/2026		
3	PCASE 7.0.8 Engineering Release 2026-09-21		
4	Section	Backcalculation Method	Bedrock Layer?
5	A15C	LEAGL	Yes
6	A05C	LEAGL	Yes
7	A10C	LEAGL	Yes
8	A20B	LEAGL	Yes
9	A03B	LEAGL	Yes
10	A07B	LEAGL	Yes
11	A08B	LEAGL	Yes
12	A17B	LEAGL	Yes
13	R01A1	LEAGL	Yes
14	R02A1	LEAGL	Yes
15	T01A	LEAGL	Yes
16	T15A	LEAGL	Yes
17	T03A	LEAGL	Yes
18	T14A	LEAGL	Yes
19	T06B	LEAGL	Yes
20	T08B	LEAGL	Yes

17.12 Representative Basins

The **Representative Basins** report displays sections in the selected LEEP evaluation that have representative basin data. A summary of impulse stiffness modulus, load, and deflections is provided for each applicable section. The report format changes slightly based on the selected Service in Evaluation Manager. The image directly below this paragraph shows an example of the Air Force and Army format of the report and the next image exhibits the Navy format.

	A	B	C	D	E	F	G	H	I	J
1	Representative Basins									
2	Inspection Date: 10/9/2017									
3	PCASE Development Build									
4	Section	ISM, kips/in.	Load, lbs.	Deflection, mils						
5				D1	D2	D3	D4	D5	D6	D7
6	A01B	1,075	52,888	49.22	41.64	32.35	24.19	17.43	12.01	8.48
7	A02B	2,381	56,130	23.57	22.02	19.45	16.38	13.53	10.94	9.16
8	A03B	1,138	53,238	46.80	42.66	36.37	30.00	24.32	19.13	14.69
9	A04B	814	52,110	64.02	54.63	42.47	32.32	24.20	17.86	12.80
10	A05B	879	52,274	59.45	51.56	40.72	31.17	23.59	17.88	13.59
11	O02C	682	28,766	42.19	34.46	24.82	16.97	11.55	8.05	5.99
12	O03C	595	28,251	47.52	40.56	31.39	23.20	16.67	11.48	8.01
13	R01A1	1,042	53,063	50.91	44.55	36.52	28.94	22.23	16.36	11.63
14	R01A2	842	52,340	62.17	53.83	42.10	31.90	24.15	18.35	13.79
15	R02C1	372	19,335	51.92	29.89	14.34	8.04	5.46	3.93	3.09
16	R02C2	352	19,050	54.17	28.89	13.82	7.58	5.42	4.29	3.56
17	R03C1	404	19,258	47.65	33.35	19.28	11.40	6.82	4.31	3.43
18	R03C2	694	19,663	28.35	19.44	13.23	8.56	5.51	3.81	3.00
19	R04A1	833	52,603	63.18	51.96	39.60	29.37	21.71	15.86	12.27
20	R04A2	916	52,526	57.34	47.49	36.41	27.13	20.03	14.26	10.98
21	T01A	941	52,165	55.44	48.32	39.15	31.00	24.15	18.28	13.29
22	T02A	422	18,677	44.21	22.35	11.56	6.98	5.14	3.95	3.27
23	T04A	700	51,321	73.28	62.85	50.22	39.29	30.48	23.19	16.83

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Representative Basins													
2	Inspection Date: 9/19/2018													
3	PCASE Development Build													
4	Branch ID	Section ID	Pave. Type	Load (lbs.)	Calculated Deflections (mils)							Basin Error (%)	Modulus	ISM (kips/in.)
5					D1 0"	D2 12"	D3 24"	D4 36"	D5 48"	D6 60"	D7 72"			
6														
7	APRON	A02C	PCC	59,986	36.24	34.41	33.14	29.06	24.29	19.93	15.69	3.5%	0.0%	1,655
8	APRON	A07B	PCC	61,805	15.43	13.83	12.94	11.08	9.12	7.39	5.83	2.5%	0.0%	4,006
9	APRON	A08B	PCC	61,969	17.88	16.22	15.33	13.27	11.03	9.03	7.15	2.7%	0.0%	3,466
10	APRON	A09C	PCC	61,640	17.54	15.91	14.89	12.70	10.54	8.56	6.81	2.5%	0.0%	3,514
11	APRON	A15B	PCC	50,971	17.48	16.10	15.19	13.08	10.81	8.85	6.96	3.0%	0.0%	2,916
12	APRON	A16B	PCC	63,043	16.32	14.41	12.97	10.56	8.30	6.57	5.39	2.1%	0.0%	3,863
13	APRON	A17B	PCC	61,389	21.39	19.23	17.34	14.06	10.97	8.48	6.36	2.6%	0.0%	2,870
14	APRON	A24C	PCC	58,508	43.60	37.21	31.20	23.94	17.52	12.77	9.27	1.8%	0.0%	1,342
15	APRON	A27C	PCC	55,813	56.52	50.96	43.19	34.63	23.31	16.20	10.00	7.0%	0.0%	987
16	APRON	A32C	PCC	57,752	54.65	47.75	38.54	28.59	20.52	14.73	10.03	2.2%	0.0%	1,057
17	APRON	A33C	PCC	59,767	32.81	30.45	28.60	24.22	19.33	14.99	11.21	4.2%	0.0%	1,822
18	APRON	A34C	PCC	61,881	22.62	19.74	17.03	13.06	9.28	6.49	4.30	5.4%	0.0%	2,736
19	APRON	A35B	AC	20,540	31.13	15.20	6.07	3.10	2.03	1.47	1.25	131.4%	0.0%	660
20	APRON	A36C	PCC	60,074	28.70	24.11	19.22	13.78	9.46	6.48	4.40	3.2%	0.0%	2,093
21	APRON	A37C	PCC	60,271	35.23	28.91	22.44	15.70	10.69	7.19	4.62	4.3%	0.0%	1,711
22	APRON	A38C	PCC	59,033	41.21	35.51	28.96	22.07	16.12	11.51	7.75	2.7%	0.0%	1,432
23	APRON	A39C	PCC	59,943	32.82	29.45	25.22	19.78	14.58	10.57	7.31	3.9%	0.0%	1,826
24	APRON	A43C	PCC	59,943	39.97	38.24	37.42	33.82	29.07	24.49	19.74	3.5%	0.0%	1,500
25	APRON	A44C	PCC	61,980	19.54	17.82	16.80	14.45	11.86	9.63	7.56	3.1%	0.0%	3,172
26	APRON	A46C	PCC	62,046	20.10	17.00	14.10	10.61	7.57	5.40	3.87	2.6%	0.0%	3,087
27	APRON	A47C	PCC	61,465	21.54	17.71	14.80	11.10	7.85	5.24	3.28	6.4%	0.0%	2,854
28	RUNWAY	O01C	AC	58,365	39.34	27.93	18.78	11.94	7.91	5.84	4.15	3.0%	0.0%	1,484
29	RUNWAY	O02C	AC	47,235	49.99	26.36	12.35	6.83	4.57	3.32	2.59	1.3%	0.0%	945
30	RUNWAY	O03C	PCC	59,888	31.42	26.12	19.97	13.44	8.44	5.26	3.40	7.6%	0.0%	1,906

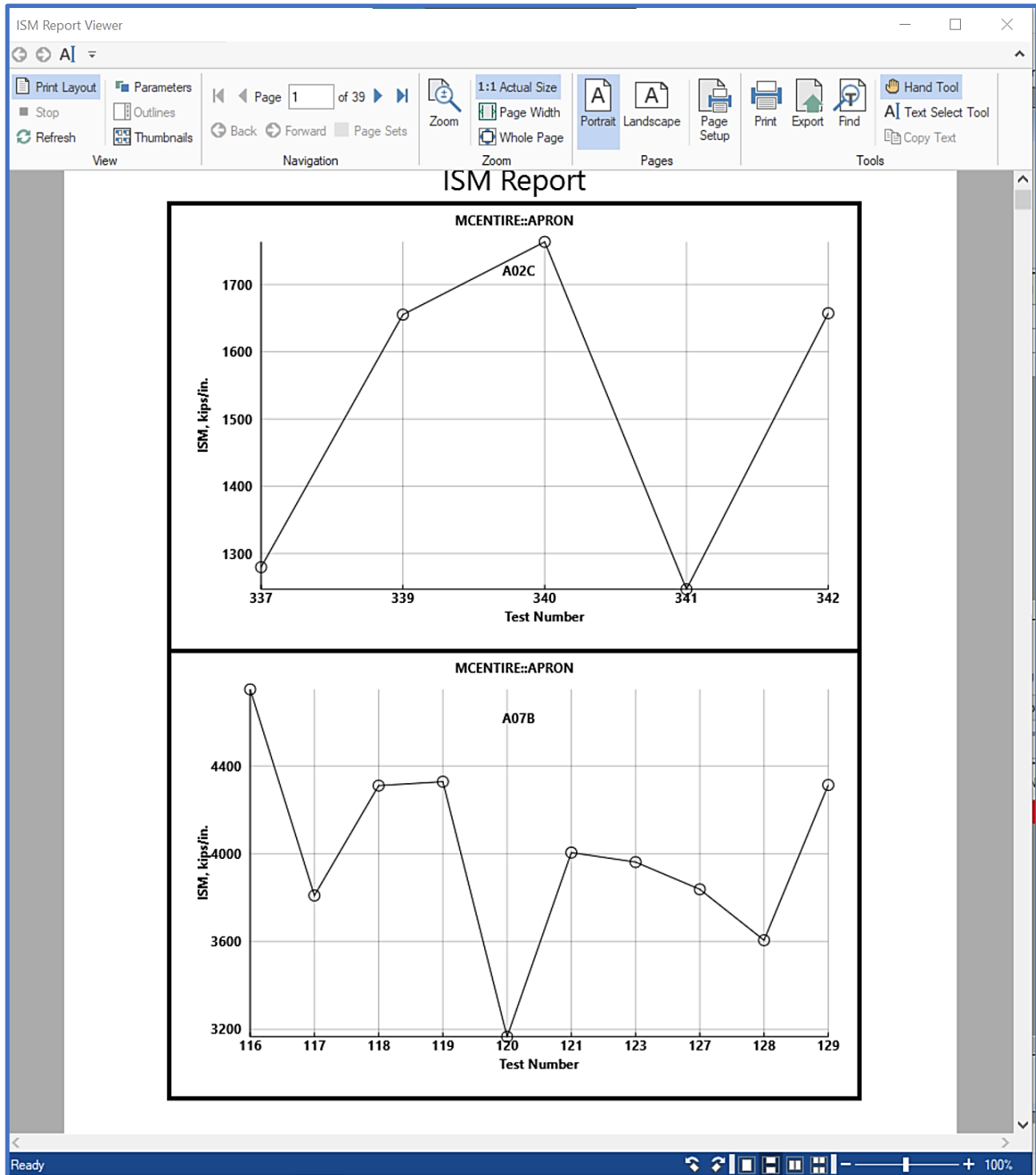
17.13 ISM Report – All Stations

The ISM – All Stations report lists all stations and coinciding impulse stiffness modulus values for imported .FWD data within the current database. The report data is derived from the entire database.

	A	B	C	D	E	F	G	H	I	J	K	L
1	ISM-All Stations											
2	Inspection Date: 9/20/2021											
3	PCASE Development Build											
4	Station	Drop	Latitude	Longitude	ISM1	ISM2	ISM3	ISM4	ISM5	ISM6	ISM7	PID
5	1	2			6839	7416	8004	8831	9678	10705	11658	SAVANNAH:APRON:A18C
6	2	2			6738	7422	8012	8655	9440	10434	11639	SAVANNAH:APRON:A18C
7	3	2			7550	8378	9142	10043	10980	12281	13837	SAVANNAH:APRON:A18C
8	4	2			7293	8332	9098	9985	10736	12041	13292	SAVANNAH:APRON:A18C
9	5	2			7745	8480	8890	9356	10120	11121	12291	SAVANNAH:APRON:A18C
10	6	2			8529	9619	10336	11169	11934	13115	14315	SAVANNAH:APRON:A18C
11	7	2			6749	7521	8295	9148	10112	11302	12598	SAVANNAH:APRON:A18C
12	8	2			6786	7527	8154	8961	9676	10775	11667	SAVANNAH:APRON:A18C
13	9	2			6767	7353	7740	8237	9149	10015	11186	SAVANNAH:APRON:A18C
14	10	2			6874	7527	8375	9394	9791	10869	12189	SAVANNAH:APRON:A18C
15	11	2			8746	9532	9989	10831	11827	13196	14493	SAVANNAH:APRON:A12B
16	11	2			8746	9532	9989	10831	11827	13196	14493	SAVANNAH:APRON:A18C
17	12	2			3848	4511	5240	6036	6944	8208	9693	SAVANNAH:APRON:A12B
18	12	2			3848	4511	5240	6036	6944	8208	9693	SAVANNAH:APRON:A18C
19	13	2			6650	7286	7982	8760	9404	10824	11989	SAVANNAH:APRON:A12B
20	13	2			6650	7286	7982	8760	9404	10824	11989	SAVANNAH:APRON:A12B
21	14	2			7243	8266	9075	10111	11243	12607	13821	SAVANNAH:APRON:A12B
22	15	2			6238	7247	7925	8834	10375	12210	14441	SAVANNAH:APRON:A12B
23	16	2			7182	8059	8421	9209	10627	11866	13372	SAVANNAH:APRON:A12B
24	17	2			8794	9863	10320	11164	12037	13001	13968	SAVANNAH:APRON:A12B
25	18	2			7130	7936	8791	9446	10876	12340	14225	SAVANNAH:APRON:A12B
26	19	2			8040	9048	9917	10891	12150	13707	15558	SAVANNAH:APRON:A12B
27	20	2			8311	9601	10602	11836	13335	15308	17444	SAVANNAH:APRON:A12B
28	21	2			7102	8150	9025	10077	11429	13054	14480	SAVANNAH:APRON:A12B
29	22	2			7836	8794	9694	10798	11991	13571	15272	SAVANNAH:APRON:A12B
30	23	2			6715	7689	8529	9468	10932	12766	14479	SAVANNAH:APRON:A12B
31	24	2			6672	7483	8169	9034	10121	11396	13008	SAVANNAH:APRON:A12B
32	25	2			4024	4788	5622	6552	7707	9253	11180	SAVANNAH:APRON:A12B
33	26	2			7757	8893	9883	11204	12499	14301	16211	SAVANNAH:APRON:A12B
34	27	2			7239	8488	9475	10702	11925	13806	15536	SAVANNAH:APRON:A12B
35	28	2			7701	8924	9904	11044	12350	14039	15708	SAVANNAH:APRON:A12B
36	29	2			7899	9026	9881	10894	12090	13519	15021	SAVANNAH:APRON:A12B
37	30	2			7760	8480	9049	9590	10342	11243	12367	SAVANNAH:APRON:A12B

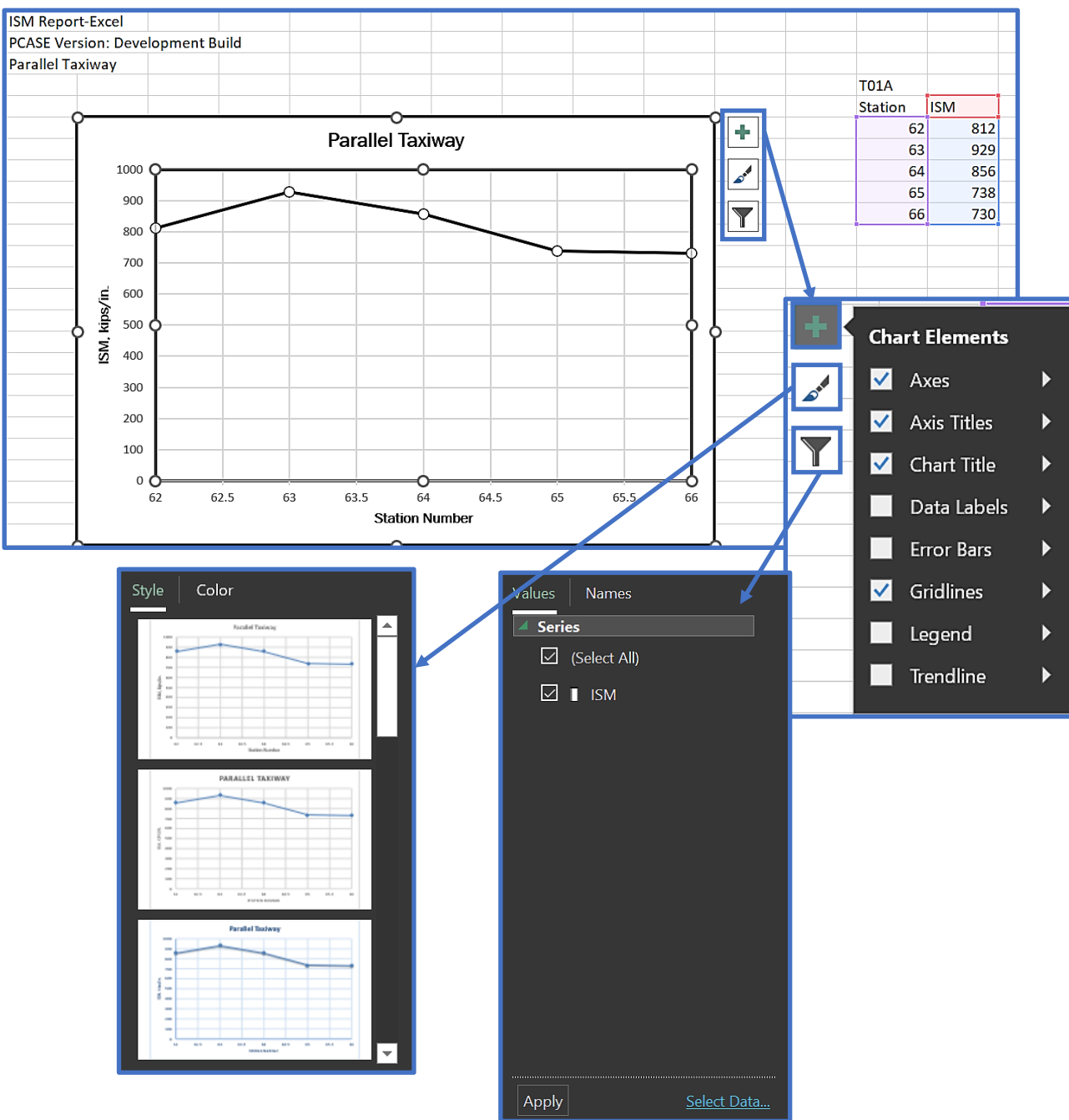
17.14 ISM Report - Images

The images ISM report can be executed for LEEP evaluation sections that have associated FWD data and selected basins. When **ISM Report-Images** is selected, a report viewer is launched that displays images of the ISM plots for each section. The report viewer includes additional functionalities that allow you to save, export, and print the report.



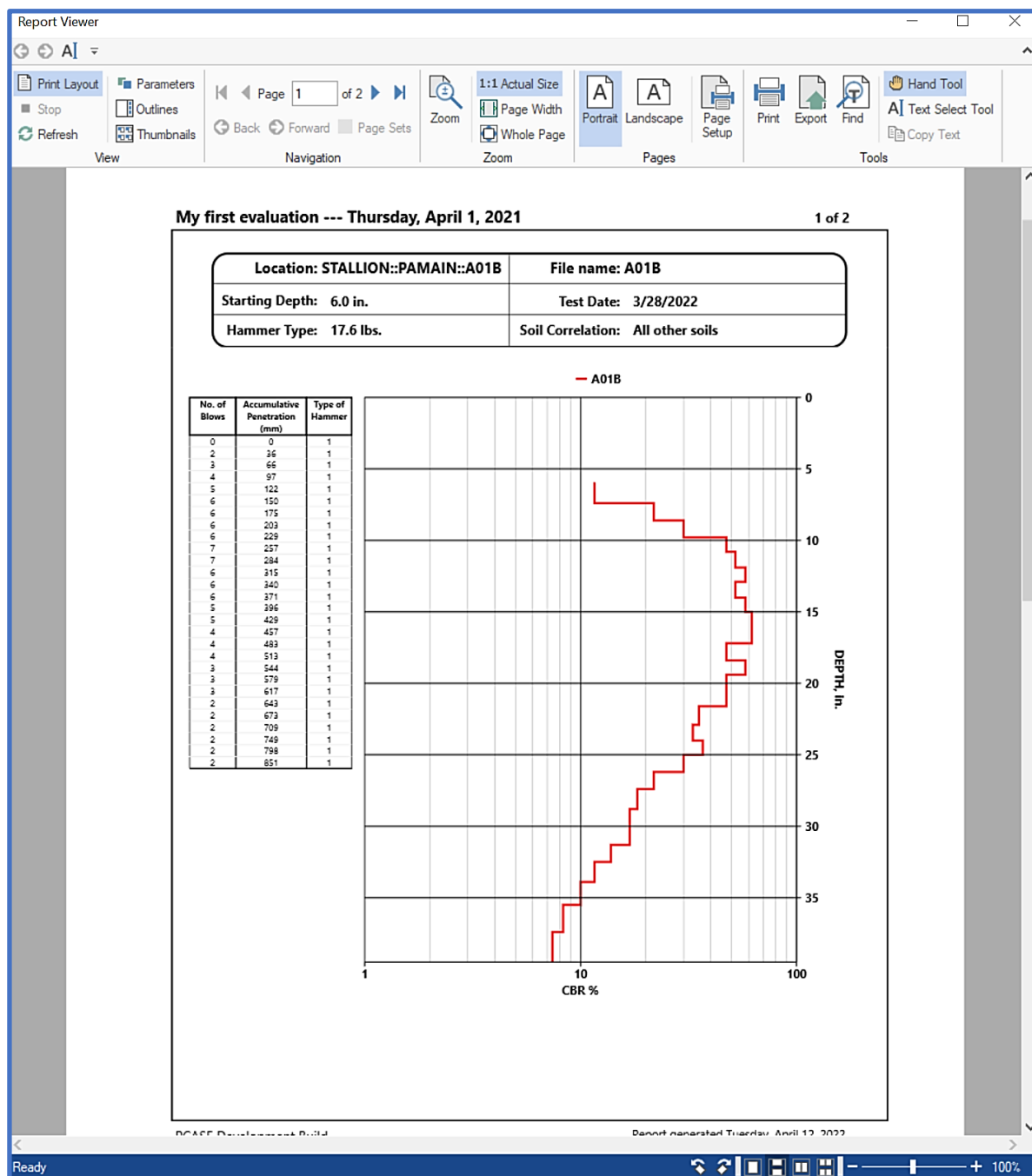
17.15 ISM Report - Excel

The Excel version of the ISM report produces a spreadsheet with interactive graphs/data. Each spreadsheet tab is separated by Branch name for the selected evaluation and ISM data is organized by Section, within each Branch tab. Select a graph to populate options for viewing chart elements, modifying the style and/or color of graphs, and value/name filters. The Station and ISM data to the right of each graph is bound to each coinciding plot.



17.16 DCP Data

The **DCP Data** report displays a summary of imported DCP test data from the current evaluation. In order to launch the DCP Data report viewer, there must be DCP test data associated with the selected evaluation. When the **DCP Data** report is selected, any tests within the selected evaluation are automatically selected by default. Tests can be unselected within the grid prior to running the report. The report viewer includes options to view, save, export, or print the report.



17.17 Contingency PCI Report

The Contingency PCI report provides a summary of pavement distress data from the Contingency PCI form. Sample size, calculated section and sample PCI, % load-related distress, and details about each sample's pavement distresses are included in this report. The Section PCI and Sample PCI column values are colored based on the following ratings in Table 5.

TABLE 5, Pavement Condition Index (PCI) Rating Scale		
Condition	Rating	Definition
Good	86 - 100	Pavement has minor or no distresses and will require only routine maintenance.
Satisfactory	71 - 85	Pavement has scattered low-severity distresses that should need only routine maintenance.
Fair	56 - 70	Pavement has a combination of generally low- and medium-severity distresses. Maintenance and repair needs should be routine to major in the near term.
Poor	41 - 55	Pavement has low-, medium-, and high-severity distresses that probably cause some operational problems. Maintenance and repair needs should range from routine to reconstruction in the near term.
Very Poor	26 - 40	Pavement has predominantly medium- and high-severity distresses causing considerable maintenance and operational problems. Near-term maintenance and repair needs will be intensive.
Serious	11 - 25	Pavement has mainly high-severity distresses that cause operational restrictions. Repair needs are immediate.
Failed	0 - 10	Pavement deterioration has progressed to the point that safe aircraft operations are no longer possible. Complete reconstruction is required.

	Section PID	Section PCI	Section Total Area	Units	% Load-related Distress	Sample	Sample PCI	Sample Size	Units	Distresses				
										Distress	Severity	Quantity	Units	Deduct
1	A01B	19.7	1,000	Slabs	76.5	01	19.7	20	Slabs	CORNER BREAK	H	5.00	Slabs	41.05
2										CRACKS LONG/TRANS/DIAG	M	5.00	Slabs	31.75
3										JOINT SEAL DAMAGE	H	20.00	Slabs	12.00
4										SMALL PATCH (<5 SF)	L	2.00	Slabs	1.73
5										SCALING	L	3.00	Slabs	2.34
6										SETTLEMENT FAULTING	L	1.00	Slabs	4.61
7										SHATTERED SLAB INTERSECTING CRACKS	L	2.00	Slabs	17.20
8										JOINT SPALLING	L	5.00	Slabs	6.95
9										DEPRESSION	L	500.00	SqFt	26.92
10										LONGITUDINAL TRANSVERSE CRACKING	M	200.00	Ft	22.78
11	R01A	66.7	10,000	SqFt	0.0	01	66.7	5,000	SqFt	WEATHERING	L	100.00	SqFt	0.68
12										DEPRESSION	L	200.00	SqFt	17.15
13	R02C	55.5	10,000	SqFt	0.0	01	55.5	5,000	SqFt	LONGITUDINAL TRANSVERSE CRACKING	M	500.00	Ft	36.51
14										OIL SPILLAGE	N/A	1.00	SqFt	2.00
15	R03A	50.9	10,000	SqFt	0.0	01	50.9	5,000	SqFt	WEATHERING	L	200.00	SqFt	0.96
16										BLOCK CRACKING	L	1,000.00	SqFt	21.24
17										DEPRESSION	M	100.00	SqFt	14.49
18										LONGITUDINAL TRANSVERSE CRACKING	L	200.00	Ft	12.52
19										LONGITUDINAL TRANSVERSE CRACKING	M	200.00	Ft	22.78
20										WEATHERING	L	500.00	SqFt	1.72
21										BLOCK CRACKING	L	500.00	SqFt	17.01
22										BLOCK CRACKING	M	500.00	SqFt	23.45
23										CORRUPTION	L	400.00	SqFt	26.57
24										RAVELING	L	200.00	SqFt	6.00
25	R04A	50.6	10,000	SqFt	0.0	01	50.6	5,000	SqFt	RAVELING	M	200.00	SqFt	13.83
26										WEATHERING	L	500.00	SqFt	1.72
27										WEATHERING	M	500.00	SqFt	5.42
28										BLOCK CRACKING	L	200.00	SqFt	12.62
29										BLOCK CRACKING	M	200.00	SqFt	17.70
30										CORRUPTION	L	500.00	SqFt	29.15
31										RAVELING	L	250.00	SqFt	8.00
32										RAVELING	M	300.00	SqFt	16.50
33										WEATHERING	L	500.00	SqFt	1.72
34										WEATHERING	M	500.00	SqFt	5.42
35	R05C	52.3	10,000	SqFt	0.0	01	52.3	5,000	SqFt	BLOCK CRACKING	L	300.00	SqFt	14.41
36										BLOCK CRACKING	M	400.00	SqFt	21.85
37										LONGITUDINAL TRANSVERSE CRACKING	L	500.00	Ft	23.27
38										RAVELING	M	400.00	SqFt	18.73
39										WEATHERING	M	500.00	SqFt	5.42
40										BLOCK CRACKING	L	100.00	SqFt	10.00
41										BLOCK CRACKING	M	100.00	SqFt	14.49
42										LONGITUDINAL TRANSVERSE CRACKING	L	200.00	Ft	12.52
43										LONGITUDINAL TRANSVERSE CRACKING	M	200.00	Ft	22.78
44										WEATHERING	L	100.00	SqFt	0.68
45	T01A	103.0	10,000	SqFt	0.0	01	103.0	5,000	SqFt	BLOCK CRACKING	L	400.00	SqFt	15.82
46										BLOCK CRACKING	M	500.00	SqFt	23.45
47										LONGITUDINAL TRANSVERSE CRACKING	L	500.00	Ft	23.27
48										PATCHING UTILITY CUT	M	200.00	SqFt	17.41
49										POLISHED AGG	N/A	1.00	SqFt	1.50
50										LONGITUDINAL TRANSVERSE CRACKING	L	100.00	Ft	2.00
51										LONGITUDINAL TRANSVERSE CRACKING	M	200.00	Ft	22.78
52										LONGITUDINAL TRANSVERSE CRACKING	H	100.00	Ft	27.18
53										WEATHERING	L	100.00	SqFt	0.68
54										BLOCK CRACKING	L	400.00	SqFt	15.82
55	T02A	63.2	10,000	SqFt	0.0	01	63.2	5,000	SqFt	BLOCK CRACKING	M	500.00	SqFt	23.45
56										LONGITUDINAL TRANSVERSE CRACKING	L	500.00	Ft	23.27
57										LONGITUDINAL TRANSVERSE CRACKING	M	400.00	Ft	32.77
58										PATCHING UTILITY CUT	M	500.00	SqFt	27.54
59										WEATHERING	L	500.00	SqFt	1.72
60										LONGITUDINAL TRANSVERSE CRACKING	L	500.00	Ft	23.27
61										LONGITUDINAL TRANSVERSE CRACKING	M	1,000.00	Ft	48.98
62										LONGITUDINAL TRANSVERSE CRACKING	H	300.00	Ft	44.36
63										POLISHED AGG	N/A	1.00	SqFt	1.50
64										WEATHERING	L	1,000.00	SqFt	2.81
65	T06C	8.1	10,000	SqFt	59.7	01	8.1	5,000	SqFt	ALLIGATOR CRACKING	M	5,000.00	SqFt	84.10
66										RAVELING	M	5,000.00	SqFt	56.77
67										ALLIGATOR CRACKING	M	2,000.00	SqFt	74.31
68										BLOCK CRACKING	M	1,000.00	SqFt	29.50
69										RAVELING	M	1,000.00	SqFt	28.16

17.18 CAPE PCI Summary Table

The CAPE PCI Summary Table displays PCI condition ratings and pavement distress severity levels for each inputted distress on the Contingency PCI form.

Table 6, Summary of Pavement Condition Index Results																		
Airfield Section	Condition Rating	Flexible Pavement (AC) Distresses																
		Alligator or Fatigue Cracking	Blocking	Block Cracking	Corrugation	Depression	Joint Block Erosion	Joint Reflection Cracking	Longitudinal Transverse Cracking	Oil Spillage	Potentiality of Caliche	Polished Aggregate	Reinforcing	Routing	Shoving of Asphalt by PCC	Slippage Cracking	Swall	Weathering
R01A	Good					L			M									L
R02C	Good					L			M	X								L
R03A	Good			LM		L			LM									L
R04A	Good			LM	L								LM					LM
R05C	Good			LM									LM					LM
R06A	Good			LM					L				M					M
T01A	Good																	
T02A	Good			LM					LM		M	X						
T03C	Good								LMH									L
T04C	Good			LM					LM		M							L
T05A	Good								LMH			X						L
T06C	Fair	M											M					
T07A	Serious	M		M									M					
Airfield Section	Condition Rating	Rigid Pavement (PCC) Distresses																
		Blowing	Corner Break	Longitudinal Transverse Cracking	Distress "Y" Cracking	Joint Seal Damage	Patch, Sealant 4" x 4"	Patch, Sealant 4" x 4"	Patch, Largeability Crack 5-48"	Popping	Pumping	Scaling/Map Cracking	Settlement/Scaling	Shrinkage Cracking	Shrinkage Cracking	Spalling, Joint	Spalling, Corner	Other Distress (Describe)
A01B	Serious	H		M		H		L	LM			L	L			L		
T09A	Serious	LM		LMH												L		

17.19 CAPE Allowable Passes Table (PCN) or (PCR)

The CAPE Allowable Passes Table displays allowable pass levels for sections that use individual traffic analysis. For PCR calculation, sections must be calculated using the individual vehicle PCR option to execute this report. The Report PCN/PCR column displays PCN or PCR results for the C-17A at 50,000 passes (if included in traffic pattern used for analysis).

	A	B	C	D	E	F	G	H
1	TABLE 2, Allowable Pass Levels							
2	Section	Report PCN	Allowable Passes					
3			(# of passes at maximum weight before 100% of the remaining pavement life is used)					
4	Aircraft		C-130H	C-17A				
5	Weight (in pounds)		125,000	585,000				
6	A01B	2/F/A/Y/T	77	2				
7	R01A	0/F/A/Y/T	13	1				
8	T01A	9/F/A/Y/T	44,743	15				

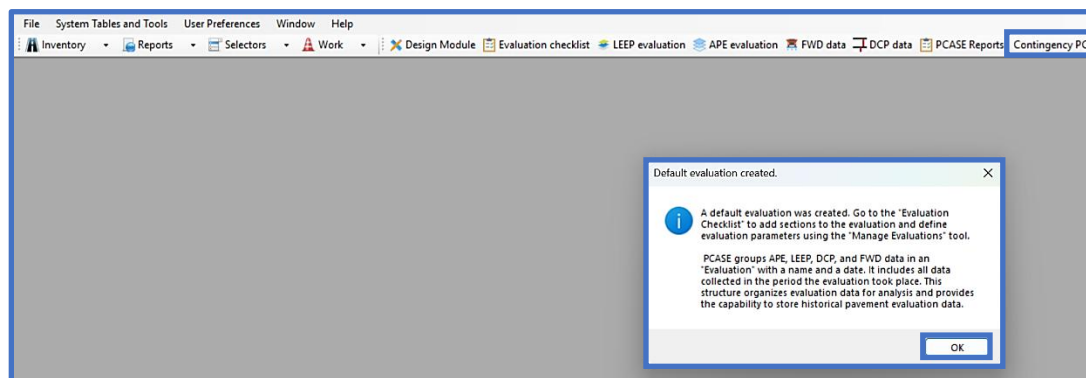
	A	B	C	D	E	F	G	H
1	TABLE 2, Allowable Pass Levels							
2	Section	Report PCR	Allowable Passes					
3			(# of passes at maximum weight before 100% of the remaining pavement life is used)					
4	Aircraft		C-130H	C-17A				
5	Weight (in pounds)		125,000	585,000				
6	A01B	632/F/A/Y/C	50,000+	50,000+				
7	R01A	357/F/B/Y/C	50,000+	531				
8	T01A	246/F/A/Y/C	7,408	166				

18 Contingency PCI

The Contingency PCI form allows users to input sample distress data for ad-hoc sections or existing inventory sections and calculate PCI data. Calculated PCI and % load-related distress values from the Contingency PCI form propagate to the APE evaluation and LEEP evaluation forms automatically, so that the values are readily available to use in analyses. A series of reports that summarize PCI calculator data can also be launched from the form.

18.1 Getting Started

Open or create a new database prior to beginning. For instructions on how to import or create a database; reference [Chapter 2 File Menu](#). If using an existing database, open the appropriate evaluation. If you created a new database, select **Contingency PCI** from the toolbar and a default evaluation will be created automatically.

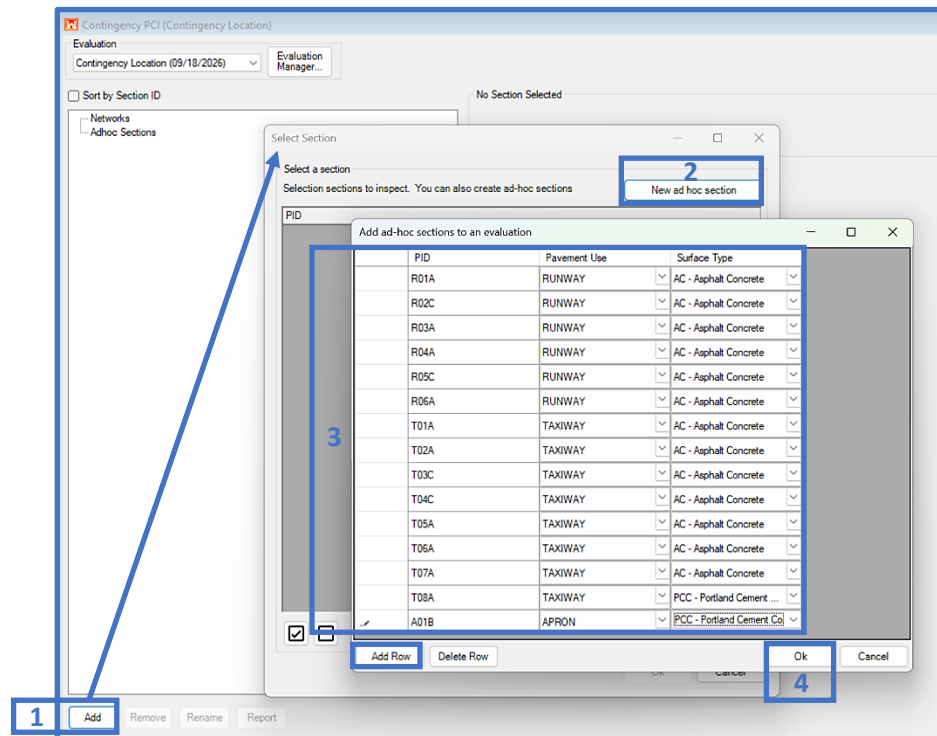


On the Contingency PCI form, select Evaluation Manager to update or define parameters for the evaluation. Reference Chapter 12 Evaluation Checklist, [Section 12.3 Evaluation Manager](#) for more information on updating the fields within Evaluation Manager. If a default evaluation was created, you can rename it to the appropriate evaluation location. Close Evaluation Manager and return to the Contingency PCI form to continue.

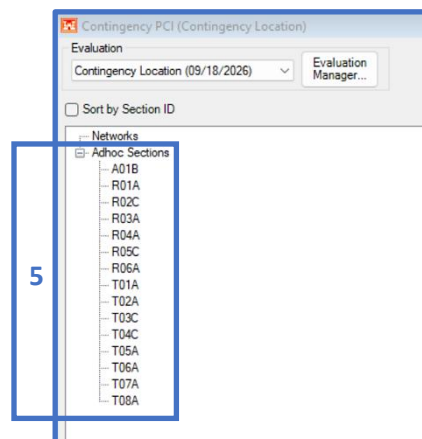
A screenshot of the 'Evaluation Manager' dialog box. It has a title bar 'Evaluation Manager' and a close button. The 'Evaluation' section at the top shows 'Contingency Location (9/18/2026)' with buttons for 'New', 'Copy', 'Rename', and 'Delete'. Below this are fields for 'Date' (Friday, September 10, 2026), 'Service' (Air Force), 'Description', and 'Comments'. The 'Climate' section includes 'Weather station' (State or country), 'Weather station' (No Climate Station Selected), 'Weather station info', 'Month Readings...', and 'Map'. There are 'Temperature settings' (Set 5 day mean..., Design Air Temperature 72.0°F) and a 'Consider Frost' checkbox. The 'Default evaluation settings' section includes 'Default traffic pattern' (C17 AT 50,000 PASSES), 'Report PCR Using Vehicle', 'Calculate overlays', 'Default APE settings' (Rigid criteria: Shattered Slab, Use Alpha Criteria), 'Default LEEP settings' (Rigid Failure SCI: 0, Backcalculation: Set default control parameters...), and 'Thaw Modulus Reduction Method' (Use Modulus Reduction Factors, Use FASSI or FAIR Values). At the bottom are 'Mark as historical' and 'Close' buttons.

In the following example, ad-hoc sections will be created. However, if the database has an existing inventory, the sections will be available for selection after you select the **Add** button.
Note: If inventory sections do not possess required slab or section area data, a warning message displays with instructions.

1. Select the **Add** button to bring sections into Contingency PCI.
2. Click on **New ad hoc section** to create sections for the evaluation.
3. Define each section as shown below. Multiple sections can be created at one time; click **Add Row** to add each subsequent section.
4. Click **OK** once all sections have been defined.

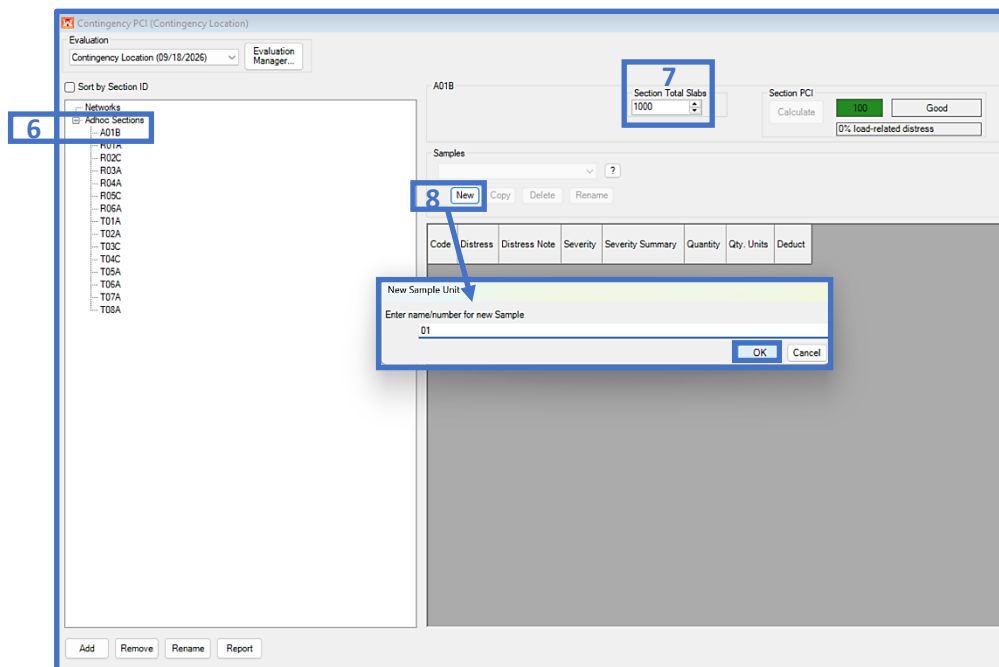


5. The ad-hoc sections are now available for selection within the tree.

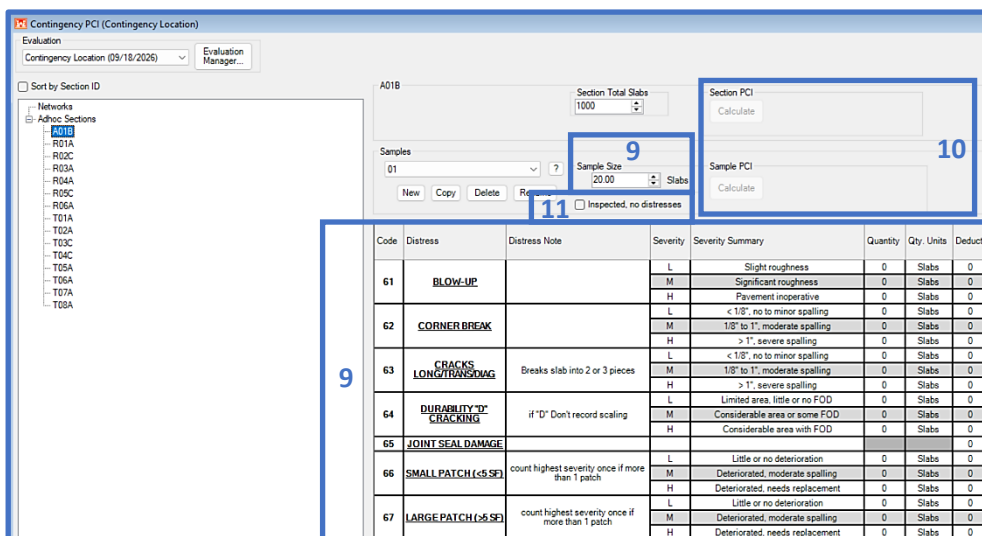


18.2 PCI Calculator

6. Select a section from the tree.
7. Section Total Slabs or Section Total Area quantities can be updated at this point, or after samples have been created.
8. Select New to add a sample unit, then enter a name, and click OK.



9. A sample is created and the distress table populates. The Sample Size field is also displayed so that you may change the number of slabs or total sample area.
10. The Calculate buttons for Section PCI and Sample PCI become enabled once distress quantities are present for a given section.
11. If an inspection revealed no new distresses, select the Inspected, no distresses checkbox.



18.2.1 Sample and Distress Data

12. Add quantities or select severity levels for each distress. If a distress requires a L, M, or H severity input (eg., joint seal damage), then the severity level is selectable from the **Severity** column. Otherwise, distress quantities are inputted within the **Quantity** column.
13. The validation logic will notify you of any unacceptable values.
14. Deduct values are calculated automatically, when applicable.
15. The **Calculate Sample PCI** button is now enabled, once the **Sample PCI** is calculated the **Section PCI Calculate** button will become enabled.

A01B

Section Total Slabs: 1000

Section PCI Calculate

Samples: 01

Sample Size: 20.00 Slabs

New Copy Delete Rename

☐ Inspected, no distresses

Code	Distress	Distress Note	Severity	Severity Summary	Quantity	Qty. Units	Deduct
64	DURABILITY "D" CRACKING	if "D" Don't record scaling	L	Limited area, little or no FOD	0	Slabs	0
			M	Considerable area or some FOD	0	Slabs	0
			H	Considerable area with FOD	0	Slabs	0
65	JOINT SEAL DAMAGE		H	Generally poor condition, replace			0
66	SMALL PATCH (<5 SF)	count highest severity once if more than 1 patch	L	Little or no deterioration	2	Slabs	0
			M	Deteriorated, moderate spalling	0	Slabs	0
			H	Deteriorated, needs replacement	0	Slabs	0
67	LARGE PATCH (>5 SF)	count highest severity once if more than 1 patch	L	Little or no deterioration	0	Slabs	0
			M	Deteriorated, moderate spalling	0	Slabs	0
			H	Deteriorated, needs replacement	0	Slabs	0
68	POPOUTS	(> 3 SY overall)	N/A		0	Slabs	0
69	PUMPING	count all slab	ANY		0	Slabs	0
70	SCALING	count highest severity on slab ncount highest severity on slab	L	Minimal paste loss, no FOD	3	Slabs	0
			M	Some FOD potential	0	Slabs	0
			H	High FOD potential	0	Slabs	0
71	SETTLEMENT FAULTING	Count fault bwn 2 slabs as 1	L	<1/4" rwy/bxy, 1/8" to 1/2" apron	1	Slabs	0
			M	1/4" to 1/2" rwy/bxy, 1/2" to 1" apron	0	Slabs	0
			H	>1/2" rwy/bxy, >1" apron	0	Slabs	0
72	SHATTERED SLAB INTERSECTING CRACKS	Do not count other distresses if medium or high severity	L	4 or 5 pieces, low severity cracks	2	Slabs	0
			M	4 or 5 pieces, medium severity cracks	0	Slabs	0
			H	4 or 5 pieces, high severity cracks	0	Slabs	0
73	SHRINKAGE CRACK		ANY		0	Slabs	0
74	JOINT SPALLING		L	Low or Med severity cracks, little FOD	25	Slabs	0
			M	Low or Med severity cracks, some FOD		Slabs	0
			H	High severity cracks, high FOD	0	Slabs	0
75	CORNER SPALLING	within approx 2 ft of corner	L	1 or 2 pieces, little or no FOD	0	Slabs	0
			M	2 or more pieces, some FOD	0	Slabs	0
			H	2 or more pieces, high FOD	0	Slabs	0

JOINT SPALLING slab count must be ≤ sample size

16. Select **Calculate** to display the Sample PCI and % load-related distress.
17. Select **Calculate** to display the Section PCI.

Section PCI

Calculate 19.7 Serious

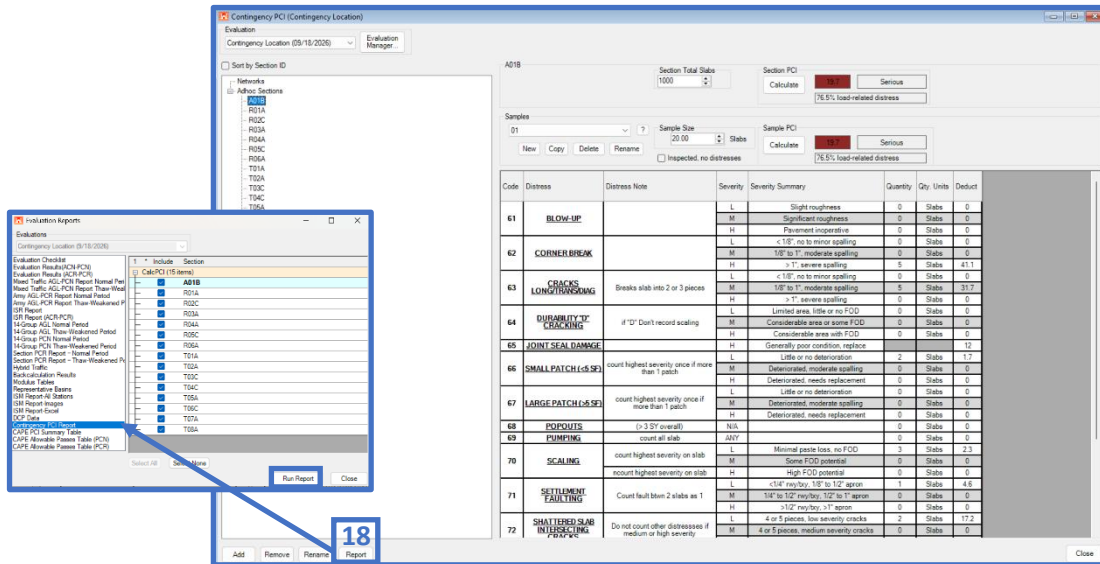
76.5% load-related distress

Sample PCI

Calculate 19.7 Serious

76.5% load-related distress

18. The Report button is enabled, now that Section PCI has been calculated based on pavement distress inputs.
19. Select Contingency PCI Report to output a spreadsheet of the distress table, PCI data, deduct values, and density values for all sections.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Section PID	Section PCI	Section Total Area	Units	% Load-related Distress	Sample	Sample PCI	Sample Size	Units	Distress	Severity	Quantity	Units	Density	Deduct
1															
2															
3															
4															
5															
6															
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20. Select **CAPE PCI Summary Table** to output a spreadsheet containing a summary of pavement condition index results.

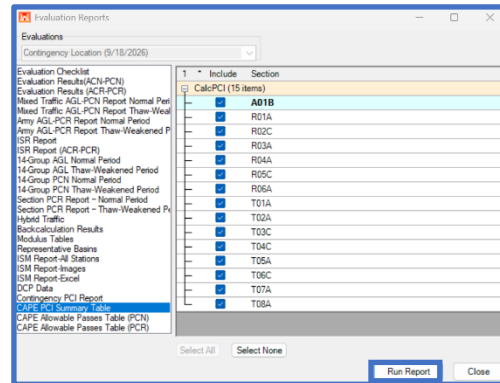


Table 6, Summary of Pavement Condition Index Results																
Flexible Pavement (AC) Distresses																
Airfield Section	Condition Rating	Alignment or Edge Cracking	Sealing	Block Cracking	Corrugations	Depressions	Joint Band Erosion	Joint Reflection Cracking	Longitudinal/Traffic Cracking	Oil Spillage	Patching/Utility Cuts	Potholes	Rebar	Shoving of Asphalt by PCC	Stripping Cracking	Seal
R01A	Good															
R02C	Good															
R03A	Good															
R04A	Good															
R05C	Good															
R06A	Good															
T01A	Good															
T02A	Good															
T03C	Good															
T04C	Good															
T05A	Good															
T06C	Good															
T07A	Good															
T08A	Good															
Rigid Pavement (PCC) Distresses																
Airfield Section	Condition Rating	Blow	Crack Seal	Longitudinal/Traffic Cracking	Distress	Joint Seal Damage	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal	Joint Seal
A01B	Good															
T05A	Good															