

ICAO AERODROME PAVEMENT WORKSHOP

Pavement Management Concepts (Part 2 – APMS Software & PAVEAIR)

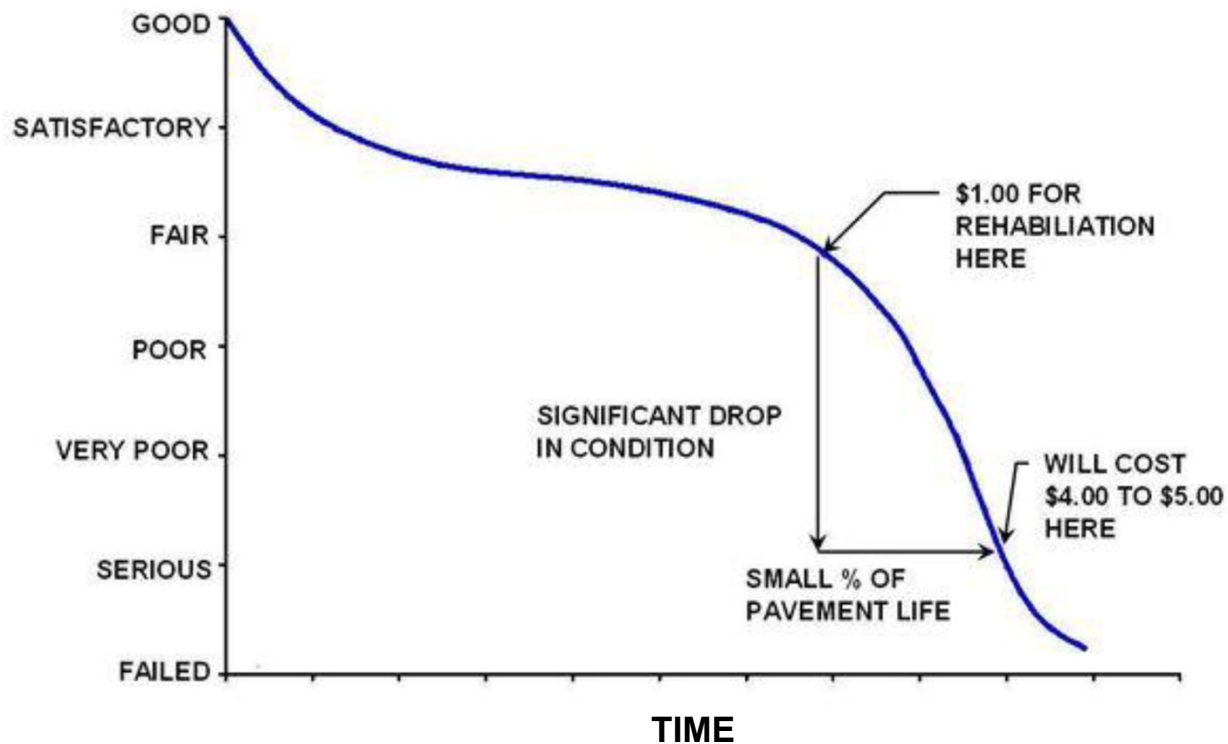
Presented to: ICAO Aerodrome Pavement Workshop
Bangkok, Thailand

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

Date: 7 February 2024



**Federal Aviation
Administration**



PCI Concepts / Distress Identification

Pavement Condition Index

- **FAA PAVEAIR uses the procedures documented in ASTM D5340 to calculate PCI.**
 - Quantify airport pavement condition based on visual inspection on the surface.
 - Numerical rating of pavement condition (0-100).
 - Does not quantify roughness, structural capacity, friction or surface texture.
- **Originally developed by the US Army Corps of Engineers for airport pavements.**
- **Embeds the division of the airport pavement inventory according to the *network/branch/section* hierarchy.**

PCI	
100	Good
85	Satisfactory
70	Fair
55	Poor
40	Very Poor
25	Serious
10	Failed
0	

APMS Pavement Hierarchy

- **Network**

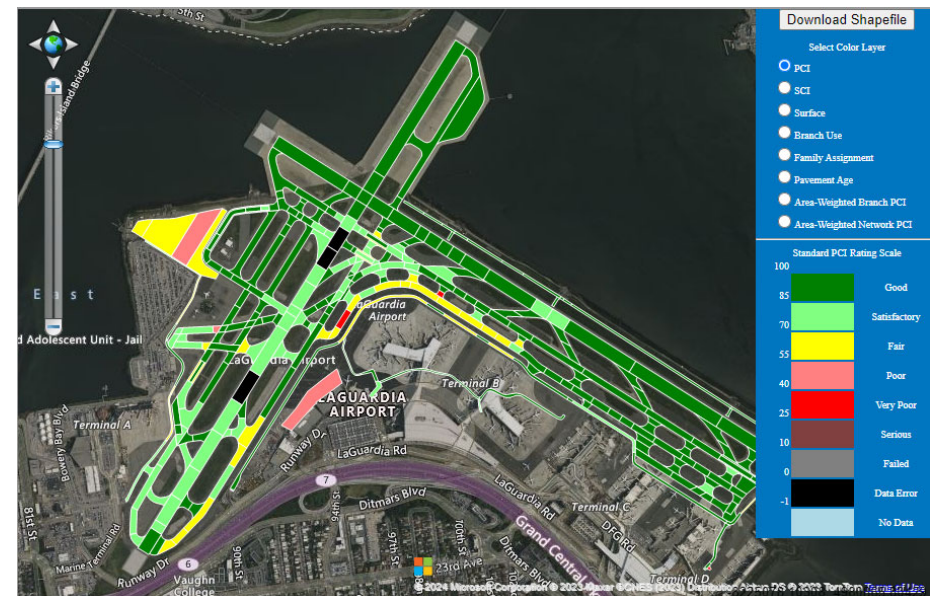
- High-level grouping of an organization's pavements for the purposes of maintenance and repair planning
- Examples: *Ohio State University Airport, LGA Airport*

- **Branch**

- Identifiable area of a pavement network having a distinct function
- Examples: *Runway 9L, Taxiway D, Apron*

- **Section**

- Subdivision of a branch with uniform construction, maintenance, usage, condition, traffic volume, and load intensity conditions
- Example: *Section A (Runway 32 end to 3,013' west)*



Pavement Condition Survey

Inspection Process

- **ASTM D 5340-23 (Airports) and ASTM D 6433-23 (Roads & Parking)**
 - Provide step-by-step procedure for identifying distresses, filling out survey forms, and calculating section PCI.
- **Create Sample Units**
 - Divide pavement sections into *Sample Units* for inspection.
- **Determine the Number of Sample Units**
 - Calculate the minimum number of sample units that must be inspected.
- **Record Distresses**
 - Condition Survey Forms
- **Enter Inspection Data**
 - Enter inspection data into FAA PAVEAIR's Update Inspection module.



Updated ASTM Standards

FAA PAVEAIR reflects current distress definitions in ASTM D5340-23 and ASTM D6433-23.

ASTM D6433-23 – Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys

Surface Type	Old Distress	New Distress (6433-10 and newer)
Asphalt	19. Weathering / Raveling	19. Raveling
		20. Weathering

ASTM D5340-23 – Standard Practice for Airport Pavement Condition Index Surveys

Surface Type	Old Distress	New Distress (5340-12 and newer)
Asphalt	12. Weathering / Raveling	12. Raveling
		17. Weathering

Surface Type	Old Distress	New Distress (5340-12 and newer)
Concrete	10. Scaling / Map Crack / Cracking	10. Scaling / Map Crack / Cracking
		16. Alkali Silica Reaction (ASR)

Types of Distresses (Airports)

Distress Codes (AC)	Distress Codes (PCC)
1. Alligator Cracking	1. Blow up
2. Bleeding	2. CornerBreak
3. Block Cracking	3. Long / Trans / Diagonal Crack
4. Corrugation	4. Durability "D" Crack
5. Depression	5. Joint Seal Damage
6. Jet Blast	6. Patching (Small)
7. Joint Reflection (PCC)	7. Patching (Large) and Utility Cut
8. Long. & Trans. Cracking	8. Popouts
9. Oil Spillage	9. Pumping
10 Patching	10. Scaling / Map Crack / Crazeing
11. Polished Aggregate	11. Settlement / Fault
12. Raveling	12. Shattered Slab
13. Rutting	13. Shrinkage Crack
14. Shoving from PCC	14. Spalling-Joints
15. Slippage Cracking	15. Spalling-Corner
16. Swell	16. Alkali Silica Reaction (ASR)
17. Weathering	

Rutting (High Severity)

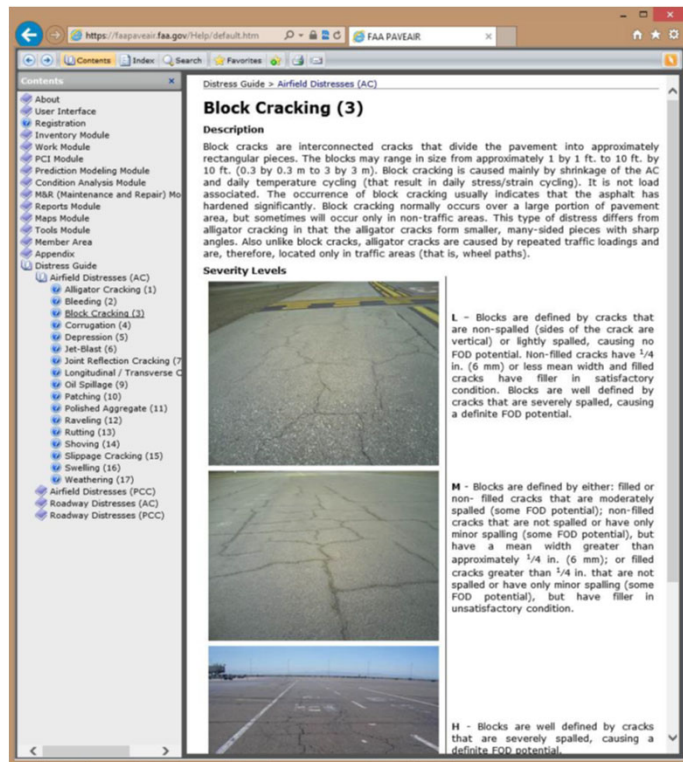


Alligator Cracking (Medium Severity)



Patching (Small)

Distress Guide



- Part of FAA PAVEAIR “Help”
- High resolution color pictures
- Shows distresses at high, medium, and low
- Explains how to properly measure each distress

<https://faapaveair.faa.gov/Help/index.html>

Create Sample Units

Divide pavement sections into sample units for inspection:

- **Asphalt** – Subdivide into sample units consisting of 464.5 m² (5,000 ft²) of contiguous area (± 186 m²)
- **Concrete** – Subdivide into sample units consisting of 20 contiguous slabs (± 8 slabs)

UFC 3-260-16
3 February 2019

Figure 2-1 Example Division of a Jointed Rigid Pavement Section into Sample Units of 20 Slabs

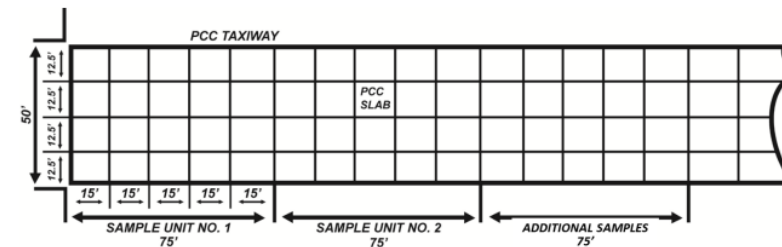
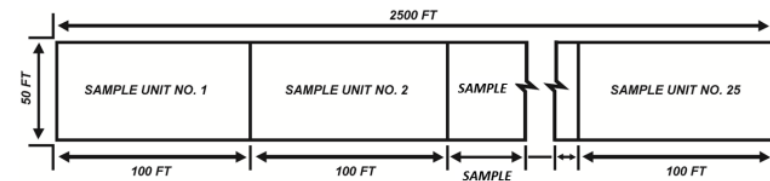


Figure 2-2 Example Division of a Flexible Pavement Section into Sample Units



SECTION DIMENSION = 50 X 2500 FT

SAMPLE UNIT = 50 X 100 FT

NUMBER OF SAMPLE UNITS = 25

Determine Number of Sample Units

- **Total Sampling**

- Total sampling is desirable for project analysis
- May not be feasible for routine management due to manpower, funds, and time required.

- **Partial Sampling**

- Calculate the minimum number of random sample units n that must be surveyed to obtain a 95% confidence level.

- Compute
$$n = \frac{Ns^2}{\left(\left(\frac{e^2}{4}\right)(N - 1) + s^2\right)}$$
 where:
 - e = acceptable error in estimating section PCI; ± 5 PCI points
 - s = standard deviation of PCI from one sample unit to another (assume 10 for AC and 15 for PCC)
 - N = total number of sample units in the section

- **Record distresses using the procedures documented in ASTM D5340-23 and ASTM D 6433-23**
 - Divide pavements into sample units
 - Perform condition survey of sample units
 - Record distresses, severity, and quantity on survey data sheets
- **Print survey data sheets from FAA PAVEAIR's *Update Inspections* Module**
 - Distresses for Asphalt Pavements
 - Distresses for Concrete Pavements
- **Enter in PMP software.**

[illegible]



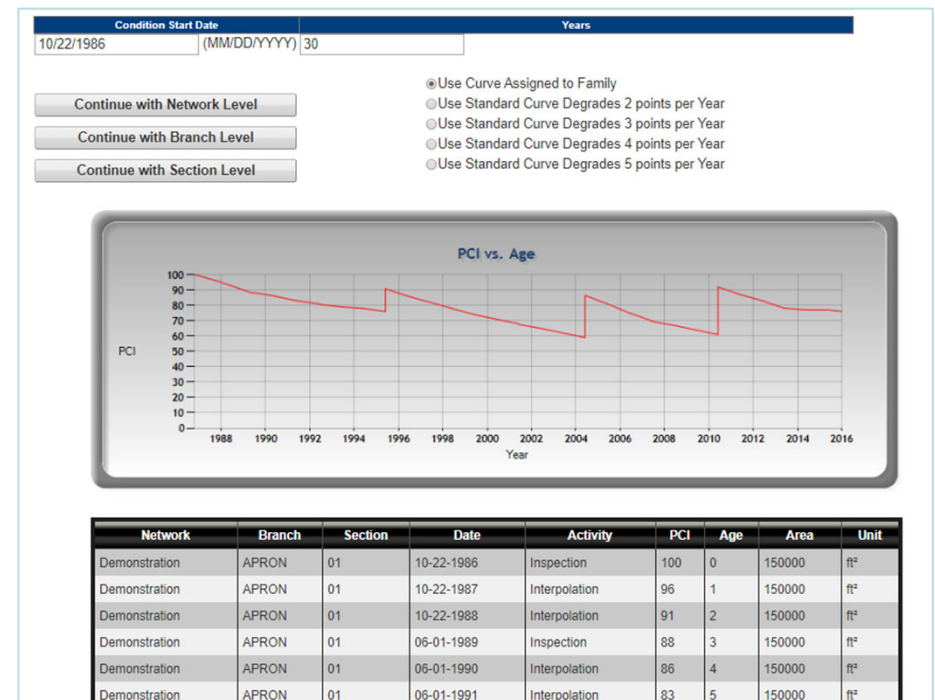
PMP Software

<https://faapaveair.faa.gov/>



PMP Software

- **Software that fulfills the requirements of an airport PMP as defined in AC 150/5380-7B:**
 - Pavement inventory
 - PMP pavement inspection schedule
 - Record keeping/database
 - Information retrieval
- **Existing software options are:**
 - PAVER™
 - FAA PAVEAIR
 - Other software (e.g., in-house)



PAVER™ and FAA PAVEAIR

PAVER™ – Current version 7.1

- Developed by the US Army ERDC Construction Engineering Research Laboratory (CERL).
- Available at:
<https://paver.colostate.edu/>
- Licensed as a desktop application (single install or networked).
- License fee: minimum USD\$1000 (+ USD\$650 annual renewal).

FAA PAVEAIR version 3.7.3

- Developed by FAA.
- Available at:
<https://faapaveair.faa.gov/>
- Web-based software application; access from anywhere.
- Option for self-hosted website (local network install).
- Publicly available & free to use.



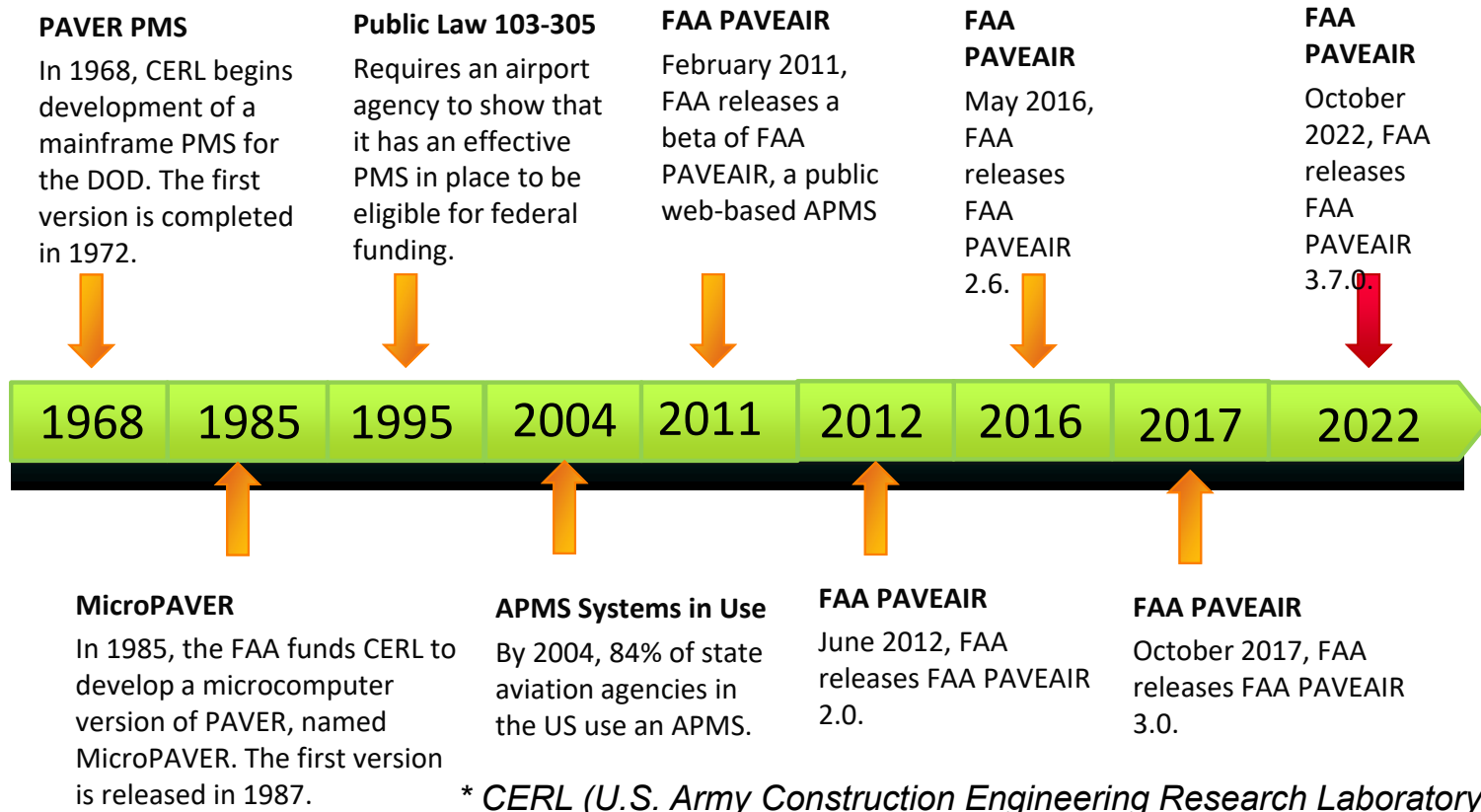
About FAA PAVEAIR

- **Airport Pavement Management System**
 - Publicly available and free to use.
 - Source code available.
 - Data can be made public, private, or shared.
 - Meets requirement for PMP software in AC 150/5380-7B.
- **Web-based**
 - Access via internet or company intranet.
 - Multi-user.
 - No software to install.
- **Regional Settings**
 - English / Metric
 - Multiple Languages

<https://faapaveair.faa.gov/>

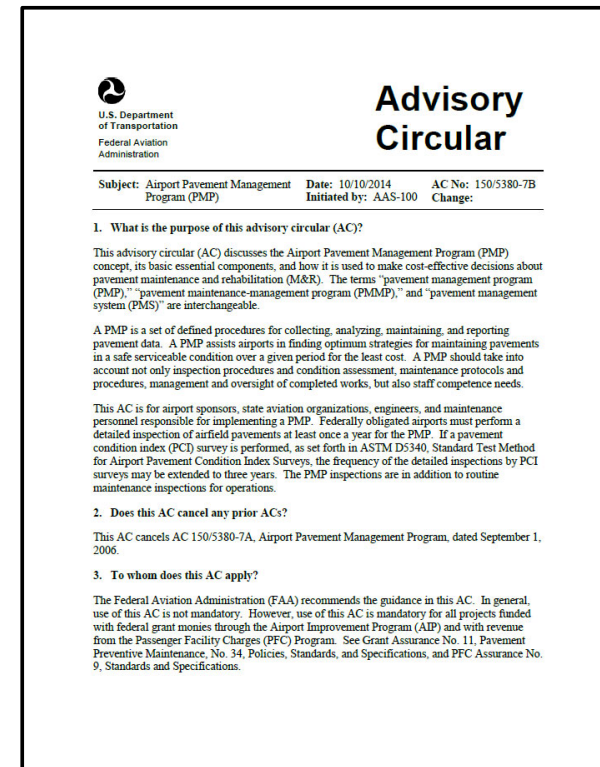
The screenshot shows the FAA PAVEAIR web application interface. At the top is a dark blue header with the Federal Aviation Administration logo and the text "Federal Aviation Administration". Below the header is a navigation bar with links: Home, Inventory, Work, PCI, Prediction Modeling, Condition Analysis, M&R, Reports, Maps, Tools, Login, Member Area, and Help. The main content area is titled "FAA PAVEAIR" and "Please choose a database". It features a "Welcome to FAA PAVEAIR" message, a description of the system, and a "Login" form with fields for User Name, Password, and a "Remember me next time" checkbox. There are also links for "Register" and "Forgot Password?". A "Databases:" section explains that users need to select a database and login to access user databases. A "Select a Database" button is present. At the bottom, it says "FAA PAVEAIR Version 3.6.3 Build 2022.6.30 View Change Log".

History of FAA PAVEAIR



FAA PAVEAIR Supports AC 150/5380-7B

- **Inventory**
- **Work History**
- **PCI / Update Inspections**
 - Calculate PCI / SCI / FOD
 - Record Condition Surveys
- **Prediction Modeling**
 - Predict future pavement conditions
 - Plot PCI vs. Age
- **Condition Analysis**
- **Maintenance and Repair Planning**
- **Reports / Maps**
 - Generate reports
 - Mapping support with shapefiles
- **Compatibility**
 - Import data from E50/E60/E65/E70 formats
 - Export data to XML (universal) format



User Options

- **FAA-Hosted Website: Unlimited Use by Public**
 - <http://faapaveair.faa.gov>
 - Free to register and use
 - FAA shoulders IT burden
 - Users still maintain control of data
- **Self-Hosted Website**
 - Available at <http://www.airporttech.tc.faa.gov>
 - Support documents, setup files, source code
 - Able to customize for your organizational needs
 - Scalable (intranet, public)
 - Data resides on your servers



User Accounts/Databases

Registered Users can:

- **Create Databases**
 - Enter a name & description.
 - Select public or private database.
 - Manually enter data; or import an existing Paver™ database.
 - Supported import formats: e50, e6x, e70
 - Multiple databases supported
- **Manage Databases**
 - Delete database
 - Change between “public” and “private”
 - Assign access/permissions to other registered users
 - Export database to XML

The screenshot displays the FAA PAVEAIR Member Area interface. At the top, the Federal Aviation Administration logo and name are visible, along with 'Exit Member Area' and 'Logout' links. The main header indicates 'FAA PAVEAIR : Member Area : Create Database' and 'Current Database: JIA_2017'.

The 'Create Database' section includes fields for 'Database Name' and 'Database Description', radio buttons for 'Public' (selected) and 'Private', and a checkbox for 'I will enter data manually.' A 'Create Database' button is at the bottom.

The 'Manage Database' section shows 'Select a Database' with a dropdown menu set to 'JIA_2017' and a 'Refresh' button. Below this, there are sections for 'Delete Database' (with a 'Delete' button), 'Change Database Access' (with radio buttons for 'Public' and 'Private', and a 'Change' button), and 'Status' (with 'Install Complete' and a 'Refresh Status' button).

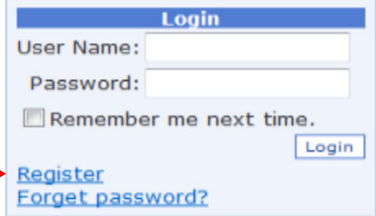
The 'Allow Following Users' section contains two tables: 'Read Only Access' and 'Grant Co-ownership'. Both tables list various users with checkboxes for selection.

Read Only Access	Grant Co-ownership
<input type="checkbox"/> 1	<input type="checkbox"/> 1
<input type="checkbox"/> 1121kms	<input type="checkbox"/> 1121kms
<input type="checkbox"/> 1178031297	<input type="checkbox"/> 1178031297
<input type="checkbox"/> 1294ar	<input type="checkbox"/> 1294ar
<input type="checkbox"/> 1stcall	<input type="checkbox"/> 1stcall
<input type="checkbox"/> 2022585461	<input type="checkbox"/> 2022585461
<input type="checkbox"/> 2439157058	<input type="checkbox"/> 2439157058
<input type="checkbox"/> 24611	<input type="checkbox"/> 24611
<input type="checkbox"/> 4lowery2	<input type="checkbox"/> 4lowery2
<input type="checkbox"/> 60422959	<input type="checkbox"/> 60422959
<input type="checkbox"/> 70jastaru	<input type="checkbox"/> 70jastaru

Create a User Account and Database

1. From the “Home” page, click on the “Register” link in the “Login” box.
2. Fill out the “User Information Form” and click “Next”
3. Fill out the “User Name and Password” form. Here is where you will choose the username and password you will use to access the system. The “security question” and “security answer” are used in case you need to recover your password. Once completed, click the “Create User” button.

(1)



The screenshot shows a 'Login' form with fields for 'User Name' and 'Password', a 'Remember me next time.' checkbox, and a 'Login' button. Below the password field, there are two links: 'Register' and 'Forget password?'. A red arrow points to the 'Register' link.

(2)



The screenshot shows the 'FAA PAVEAIR : PAVEAIR Registration' form, specifically the 'User Information' section. It contains fields for First Name, Last Name, Title, Organization, Address Line 1, Address Line 2, City, State (a dropdown menu currently showing 'ALABAMA'), Zip, Country, Phone#, Fax, and Email. There is also a 'Preferred Contact Method' dropdown menu set to 'Email'. A 'Next' button is located at the bottom right.

(3)



The screenshot shows the 'User Name and Password' form. It contains fields for User Name, Password, Confirm Password, Security Question, and Security Answer. At the bottom, there are two buttons: 'Previous' and 'Create User'.


Create a User Account and Database

4. Click on the “Create Database” link.
5. Choose a name and description for your database and enter it in the form.


[For workshop participants: it is recommended you use your last name and first initial followed by “_UserDB1” as your database name. Select “Public” and “No. I will enter data manually,” then press “Create Database.”]

(4) User Profile and Data Management Page

Seminar_SC

Profile	Data
<ul style="list-style-type: none">• Update Profile• Change Password	<ul style="list-style-type: none">• Create Database • Manage Database• Inventory Update• Work Update• Update Inspection• Upload Shapefiles• Map Assignment Tool• LCCA• Roughness Profile Data

(5)

 **Federal Aviation Administration**

[Exit Member Area](#) [Logout](#)

FAA PAVEAIR : Member Area : Create Database Current Database: DallasExec

Database Name:

Database Description:

☒ Public ☐ Private

☒ I will enter data manually. ☐ Import a MicroPAVER e65/e60/e50 file. ☐ Import a MicroPAVER e70 file.

Importing PAVERTM Data

- **Create an e65/e70 file in PAVERTM**
 - Paver Database Tools
- **Create a new FAA PAVEAIR database**
 - Select “Import a MicroPAVER e65/e60/e55 file” or
 - Select “Import a MicroPAVER e70 file.”

The screenshot shows the 'FAA PAVEAIR : Member Area : Create Database' web interface. At the top, there are links for 'Exit Member Area' and 'Logout'. Below the header, the current database is listed as 'DallasExec'. The form includes fields for 'Database Name' (containing 'Sample_DB') and 'Database Description'. There are radio buttons for 'Public' (selected) and 'Private'. Below these are three options: 'I will enter data manually', 'Import a MicroPAVER e65/e60/e50 file.' (selected), and 'Import a MicroPAVER e70 file.'. A section for 'MicroPAVER data upload' contains a 'Choose a MicroPAVER .e65/.e60/.e50 file' label and a file selection box showing 'Choose File' and 'No file chosen'. A 'Create Database' button is at the bottom.

When complete, you will see the message “The database is created successfully.” Click [FAA PAVEAIR Home](#) to select your database.



Language & Units


- **Available Languages**
 - English
 - Français
 - Español
 - Português (*Translation courtesy of ALACPA*)
- **Units**
 - U.S. Customary
 - Metric
- ***Only need to select once***

The screenshot displays the FAA PAVEAIR web application interface. The top navigation bar is blue with the FAA logo and the text "Federal Aviation Administration". Below the navigation bar, the "Preferences" page is shown. The page has a white background with a blue header. The "Preferences" section includes options for "Current Display Unit" (English), "Select Display Units" (English Units), "Current Display Language" (English), and "Select Display Language" (English). The "English Units" radio button is selected. The "Select Display Language" dropdown menu is set to "English".

The bottom section of the screenshot shows the "Bienvenue à FAA PAVEAIR" page. The page has a white background with a blue header. The "Bienvenue à FAA PAVEAIR" section includes a welcome message in French, a description of the application, and a link to "Sélectionner une base de données". The "Sélectionner une base de données" link is highlighted in blue.

Spanish User Interface

Distress Guide and Manual in Spanish



Administración

Federal de

Aviación

[Casa](#)
[Inventario](#)
[Trabajo](#)
[PCI](#)
[Modelado de Predicción](#)
[Análisis de Condición](#)
[M&R](#)
[Informes](#)
[Mapas](#)
[Herramientas](#)
[Pestaña auxiliar](#)
[Cerrar sesión](#)
[Zona de Miembros](#)
[Ayuda](#)

FAA PAVEAIR : Tools

Base de datos actual DallasExec

[Preferencias](#)
[Deducción de deterioro](#)
[Exportar base de datos](#)

Preferencias

Unidad de visualización actual:

Métrico

Seleccionar las unidades de visualización:

Métrico

Unidades inglesas

Lenguaje de pantalla actual:

Español

Seleccionar idioma de visualización:

Español

FAA PAVEAIR : PCI

Base de datos actual DallasExec

Red

Dallas Executive

Dallas Executive

Rama

AHANG

Hangar Apron

Sección

01

01

00 00

Sección 01 Resumen

Uso de rama	Superficie	Área verdadera	Anchura	Longitud
APRON	PCC	3176.73	42.37	74.98

Sección 01 Inspecciones

	Fecha de inspección	Muestras Inspeccionadas
Seleccionar	07/30/2001	8
Seleccionar	11/02/2008	8

Un condición (PCI, SCI, FOD) de valor "-1" indica que se ha detectado un error en los datos de deterioro. Las causas comunes incluyen: cantidad de deterioros mayor que el tamaño de la unidad de muestra, combinaciones incorrectas de código de deterioro y severidad, muestras marcadas con la opción "Sin deterioro" que si contienen deterioros y muestras sin deterioros que no tienen marcada la opción "Sin deterioro".

FAA PaveAir Help

▼ Contents

Inicio

Interfaz de Usuario

Trabajando con la Base de Datos

Registro

Inventario

Trabajo

PCI

Modelo de Predicción

Análisis de condición

M&R (Plan de Mantenimiento y Rehabilitación)

Informes

Mapas

Herramientas

Área de Miembros

Apéndices

Guía de Deterioros/Fallas

Deterioros/Fallas en el aeródromo (AC)

Piel de cocodrilo (Alligator Cracking) (1)

▼ Descripción

Niveles de severidad

Forma de Medición

Exudación (Bleeding) (2)

Fisuramiento en Bloque (Block Cracking) (3)

Ondulación/Corrugación (Corrugation) (4)

Depresión (Depression) (5)

Erosión por chorro de turbina (Jet Blast) (6)

Fisuras por reflexión de juntas (Joint Reflection) (7)

Fisuras longitudinales y transversales (Longitudinal/Transverse Cracking) (8)

Deterioro por Derrame de combustible (Oil Spillage) (9)

Bacheo/Reparaciones (Patching) (10)

Agregado pulido (Polished Aggregate) (11)

Desprendimiento de Agregados (Raveling) (12)

Ahuellamiento (Rutting) (13)

Desplazamiento/empuje (Shoving) (14)


Fisuras por deslaminamiento media luna (Slippage Cracking) (15)

Hinchamiento (Swelling) (16)

Peladura por Intemperismo (Weathering) (17)


Guía de Deterioros/Fallas / Deterioros/Fallas en el aeródromo (AC) / Piel de cocodrilo (Alligator Cracking) (1)

Niveles de severidad



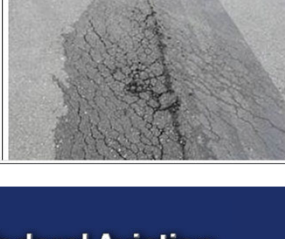
L (Bajo)

- Fisuras longitudinales muy finas que corren paralelas entre sí, sin fisuras o con pocas fisuras interconectadas. En las fisuras no se presentan desprendimientos de material.



M (Mediano)

- Evolución de los niveles de severidad bajos de "piel de cocodrilo" que pasan a conformar un patrón o red de juntas, con un ligero grado de desprendimiento. El grado medio de severidad de los deterioros de piel de cocodrilo se define por un patrón bien definido de juntas interconectadas, donde todas las piezas se mantienen firmemente en su lugar (buen entrelazado de los agregados entre las piezas).



H (Alto)

- En este nivel la red o patrón de fisuras han avanzado de tal manera que las piezas están bien definidas con desprendimiento de material en sus bordes; algunas de las piezas desprendidas se balancean bajo el tráfico y pueden causar un peligro potencial de FOD.

7 February 2024

APMS Concepts - PAVEAIR


Federal Aviation
Administration

24

Portuguese Interface

The screenshot displays the 'FAA PAVEAIR : Tools' web interface. The top navigation bar includes links for 'Casa', 'Inventário', 'Trabalho', 'PCI', 'Modelagem de previsão', 'Análise da condição', 'M&R', 'Relatórios', 'Mapas', 'Ferramentas', 'Logout', 'Área de Membros', and 'Ajuda'. The main content area shows the 'Banco de dados atual: TAP_Demo' and three tabs: 'Preferências' (selected), 'Dedução do defeito', and 'Exportação de banco de dados'. The 'Preferências' section is titled 'Preferências' and contains two settings: 'Unidade de exibição atual: Métrica' with radio buttons for 'Métrica' (selected) and 'Unidades em inglês', and 'Idioma de exibição atual: Português' with a dropdown menu set to 'Português'.

Translation courtesy of ALACPA


**Federal Aviation
Administration**

[Home](#)
[Inventory](#)
[Work](#)
[PCI](#)
[Prediction Modeling](#)
[Condition Analysis](#)
[M&R](#)
[Reports](#)
[Maps](#)
[Tools](#)
[Auxiliary Tab](#)
[Login](#)
[Member Area](#)
[Help](#)

FAA PAVEAIR
Current Database: TAP_Demo

Welcome to FAA PAVEAIR

FAA PAVEAIR is a public, web-based application designed to assist organizations in the evaluation, management, and maintenance of their pavement networks. PAVEAIR is designed to fulfill the requirements of an Airport Pavement Management System as identified in Advisory Circular (AC) 150/5380-7B. PCI calculations performed per ASTM D5340-20 or D6433-20, as appropriate.

The FAA is pleased to announce the release of FAA PAVEAIR v3.7.2. This version includes bug fixes.

Questions concerning the application or data can be addressed to Qingge Jia, FAA PAVEAIR program manager, at qingge.jia@faa.gov.

Details on the improvements made to FAA PAVEAIR are available in the [Change Log](#).

For news and upcoming events, please visit the [News](#) and [Events](#) page.

Login

User Name

Password

☐ Remember me next time

Login

Register

Forgot Password?

Databases:

Use the "Select a Database" button below to select a database. You will need to login to access your user databases. Public databases are read-only.

Select a Database

FAA PAVEAIR Version 3.7.2 build 2023.04.11 - [View Change Log](#)

FAA PAVEAIR Features and Functions

Primary Functions

- **Inventory / Manage Pavement Inventories**
- **Work / Record Pavement Work Histories**
- **PCI / Update Inspections**
 - Calculate PCI / SCI / FOD
 - Record Condition Surveys
- **Prediction Modeling**
 - Predict future pavement conditions
 - Plot PCI vs. Age
- **Condition Analysis**
 - Provides projections about the viability of pavements
- **Maintenance and Repair Planning**
- **Reports / Maps**
 - Generate reports
 - Mapping support with shapefiles
- **Compatibility**
 - Import data from MicroPAVER(e60, e65)
 - Export data to XML

The screenshot shows the FAA PAVEAIR web application interface. At the top is a dark blue header with the FAA logo and the text "Federal Aviation Administration". Below the header is a navigation bar with links: Home, Inventory, Work, PCI, Prediction Modeling, Condition Analysis, M&R, Reports, Maps, Tools, Login, Member Area, and Help. The main content area has a light blue background. On the left, it says "Welcome to FAA PAVEAIR" and provides a brief description of the application. On the right, there is a "Login" section with fields for "User Name:" and "Password:", a "Remember me next time." checkbox, and buttons for "Login", "Register", and "Forgot password?". Below the login section is a "Databases" section with a "Select a Database" button. At the bottom, it says "FAA PAVEAIR Version 2.6.0 build 2016.05.02 - View Change Log".

Mobile Data Entry

- **Works on any internet-enabled mobile device.**
 - Expensive Windows tablets not needed.
 - iPhone and Android compatible.
- **System automatically detects mobile users and switches to mobile interface.**
- **Data entered in real time and immediately available to all users.**
 - No synchronization required before or after survey.
 - PCI results immediately available to inspector.

Example Using iPhone 6 plus

PaveAir Mobile Inspection

Inspection: 01/01/2016

Construction: No

Comment:

Run Inspection PCI Delete Inspection

+ Add New Inspection:

Samples for Inspection Date 01/01/2016

Sample: 02

Type: R

Size: 20

Unit: C

Comment:

No Distress: ☐

Run Sample PCI Delete Sample

+ Add New Sample:

Distresses for Sample 02

ASTM Code	Severity	Qty	QtyUnit	Delete
6	H	8	C	Delete

Distress Code: 1 Blow Up

Severity: Low

Distress Quantity:

Quantity Unit: C

414 x 736 - iPhone 6 plus

PaveAir Mobile

Back

Inspection PCI: 77

Distress Deduct PCI

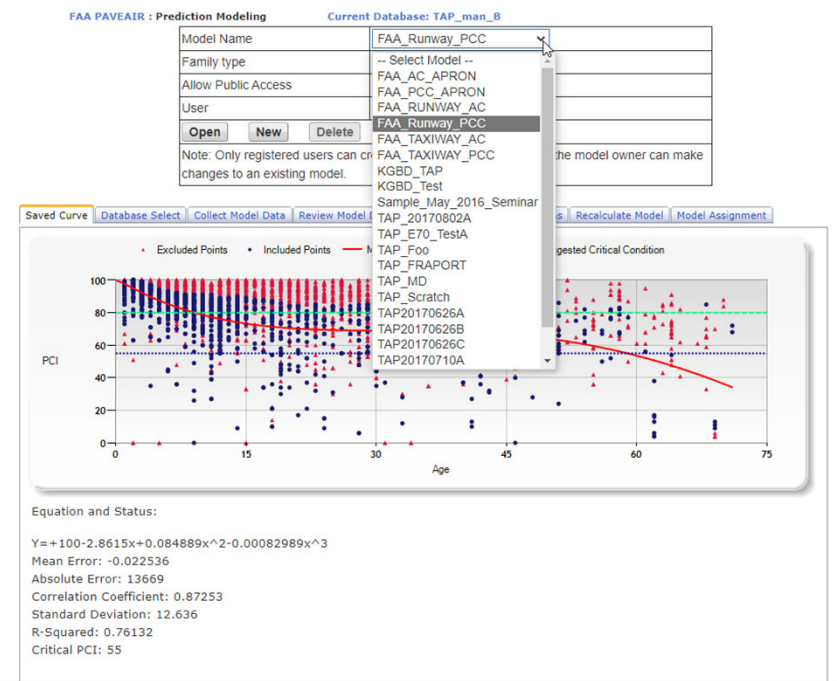
Distress

Sample Number	ASTM Code	ASTM Description	Quantity	Qty	Unit
02	6	Patching	H	8.00	C
03	6	Patching	H	8.00	C
04	6	Patching	H	8.00	C
05	6	Patching	H	8.00	C
05	6	Patching	M	3.00	C
05	13	Shrinkage Crack	N	1.00	C

414 x 736 - iPhone 6 plus

Prediction Modeling Capability

- **FAA prediction modeling library**
 - FAA-developed models.
 - Models for runway, taxiway, apron; asphalt (AC), concrete (PCC).
- **Build a family curve from:**
 - User-owned databases;
 - Databases to which user has read-only privileges; and
 - Public databases.
- **PCI, FOD, SCI versus Age**
- **Option to define critical PCI (default 60)**



User-Defined Indexes

- Define a custom index based on PCI distresses.
- Select the distress/severity combinations that contribute.
- Share with specific databases.


FAA PAVEAIR : Member Area : Update User Defined Index

ID	Owner	User Defined Index Name	User Defined Index Desc	DecreaseWithTime	Update Index	Copy
5	tparsons	Sample_Index	SampleIndex	No	Update Cancel	Copy
10	faa	FOD Index	FOD for Safety	No	Edit	Copy
11	faa	STaff	Example	No	Edit	Copy
21	hpurcell	TestFOD		Yes	Edit	Copy
30	eduah	CrackIndex	Describes Cracking	Yes	Edit	Copy

USACE Code	Use Category	ASTM Code	Distress Description	Severity	Select or Deselect All
1	Roadway/Parking	1	ALLIGATOR CR	Low	<input type="checkbox"/>
1	Roadway/Parking	1	ALLIGATOR CR	Medium	<input type="checkbox"/>
1	Roadway/Parking	1	ALLIGATOR CR	High	<input type="checkbox"/>
2	Roadway/Parking	2	BLEEDING	Low	<input type="checkbox"/>
2	Roadway/Parking	2	BLEEDING	Medium	<input type="checkbox"/>
2	Roadway/Parking	2	BLEEDING	High	<input type="checkbox"/>
3	Roadway/Parking	3	BLOCK CR	Low	<input type="checkbox"/>
3	Roadway/Parking	3	BLOCK CR	Medium	<input type="checkbox"/>
3	Roadway/Parking	3	BLOCK CR	High	<input type="checkbox"/>
4	Roadway/Parking	4	BUMPS/SAGS	Low	<input type="checkbox"/>
4	Roadway/Parking	4	BUMPS/SAGS	Medium	<input type="checkbox"/>
4	Roadway/Parking	4	BUMPS/SAGS	High	<input type="checkbox"/>
5	Roadway/Parking	5	CORRUGATION	Low	<input type="checkbox"/>
5	Roadway/Parking	5	CORRUGATION	Medium	<input type="checkbox"/>
5	Roadway/Parking	5	CORRUGATION	High	<input type="checkbox"/>
6	Roadway/Parking	6	DEPRESSION	Low	<input type="checkbox"/>
6	Roadway/Parking	6	DEPRESSION	Medium	<input type="checkbox"/>
6	Roadway/Parking	6	DEPRESSION	High	<input type="checkbox"/>

Database	Select or Deselect All
ASU_Test_AZ	<input checked="" type="checkbox"/>
ASU_Test_VT	<input checked="" type="checkbox"/>
Kentucky	<input checked="" type="checkbox"/>
LGA_2019_TAP	<input checked="" type="checkbox"/>
NAPTF	<input checked="" type="checkbox"/>
OLV2019	<input checked="" type="checkbox"/>
PAR_CID2011	<input checked="" type="checkbox"/>
PAR_CO2012	<input checked="" type="checkbox"/>
TAP_Demo	<input checked="" type="checkbox"/>

User Name	Select or Deselect All
1121kms	<input type="checkbox"/>
1178031297	<input type="checkbox"/>
1294ar	<input type="checkbox"/>
1stcall	<input type="checkbox"/>
2022585461	<input type="checkbox"/>


Federal Aviation Administration

[Exit Member Area](#)
[Logout](#)

FAA PAVEAIR : Member Area : Update User Defined Index

ID	Owner	User Defined Index Name	User Defined Index Desc	DecreaseWithTime	Update Index	Copy
5	tparsons	Sample_Index	Sample Index	No	Edit Delete	Copy
10	faa	FOD Index	FOD for Safety	No	Edit	Copy
11	faa	STaff	Example	No	Edit	Copy
21	hpurcell	TestFOD		Yes	Edit	Copy
30	eduah	CrackIndex	Describes Cracking	Yes	Edit	Copy

New UDI Name

New UDI Description

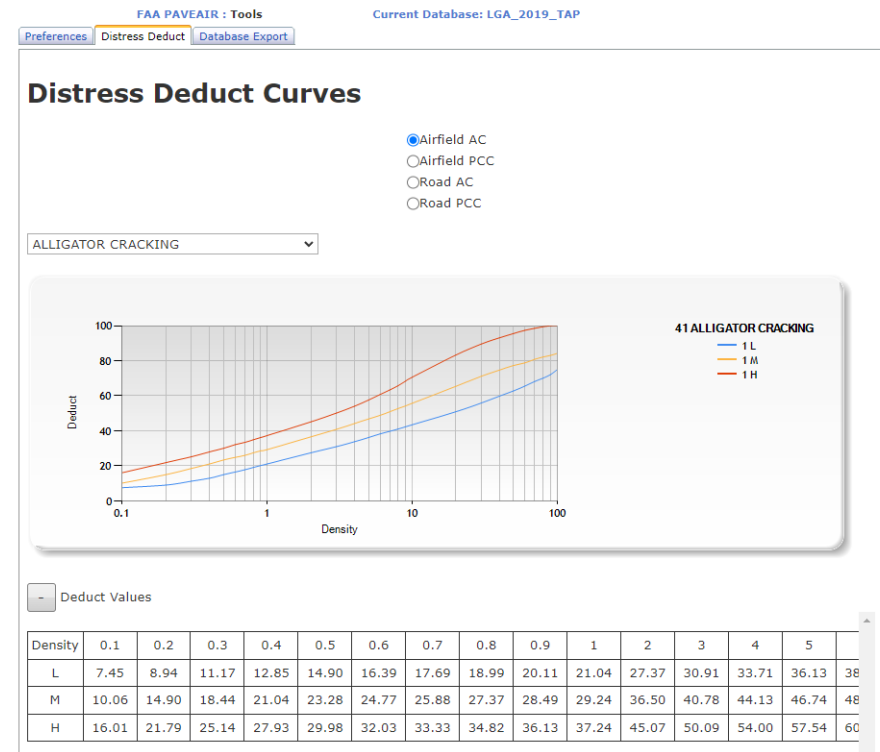
DecreaseWithTime
No

Add



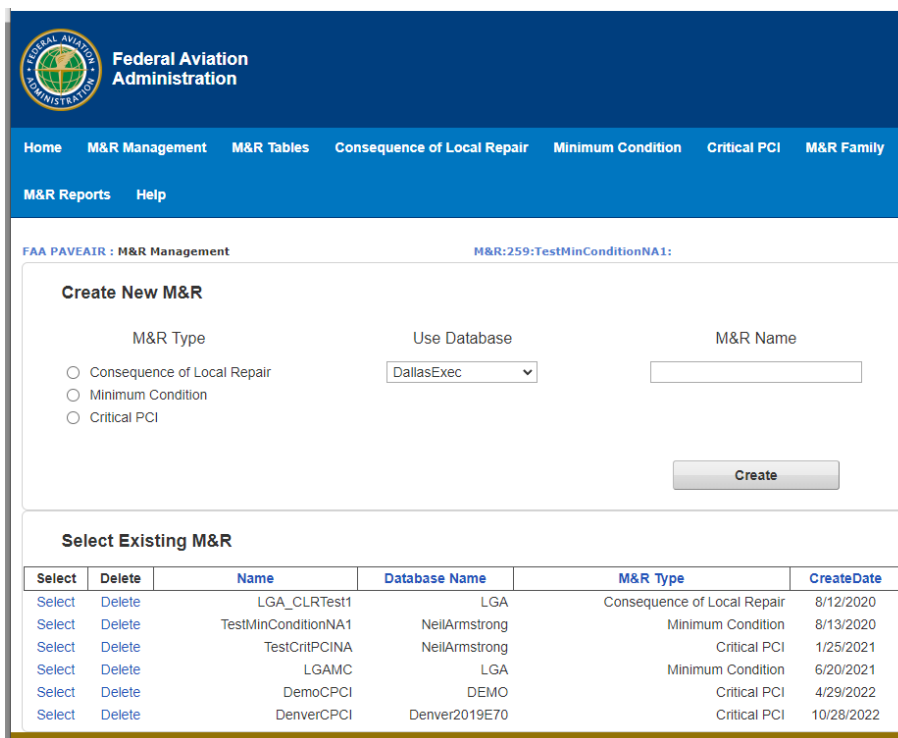
Distress Deduct Curves

- Digitized distress deduct values.
- Digitized curves.
 - Curve data provided in tabular and
 - Can be implemented easily in other programs.



Maintenance and Repair (M&R) Planning

- **Scope**
- **Timing**
- **Plan Mode**
 - Critical PCI Method
 - Minimum Condition
 - Consequence of Local Repair
- **Policies**
 - Apply Inflation Rate
 - Apply Policy in First Year
 - Global
- **M&R Data**
 - Applied Policy Consequence
 - Applied Policy Details
 - Inventory Info



Federal Aviation Administration

Home M&R Management M&R Tables Consequence of Local Repair Minimum Condition Critical PCI M&R Family

M&R Reports Help

FAA PAVEAIR : M&R Management M&R:259:TestMinConditionNA1:

Create New M&R

M&R Type Use Database M&R Name

☐ Consequence of Local Repair ☐ Minimum Condition ☐ Critical PCI

DallasExec

Create

Select Existing M&R

Select	Delete	Name	Database Name	M&R Type	CreateDate
Select	Delete	LGA_CLRTest1	LGA	Consequence of Local Repair	8/12/2020
Select	Delete	TestMinConditionNA1	NeilArmstrong	Minimum Condition	8/13/2020
Select	Delete	TestCritPCINA	NeilArmstrong	Critical PCI	1/25/2021
Select	Delete	LGAMC	LGA	Minimum Condition	6/20/2021
Select	Delete	DemoCPCI	DEMO	Critical PCI	4/29/2022
Select	Delete	DenverCPCI	Denver2019E70	Critical PCI	10/28/2022

Customizable M&R Settings

- **Localized M&R**
 - Policy
 - Work Type / Cost
 - Work Consequence
- **Global M&R**
 - Policy
- **Major M&R**
 - Minimum Condition
 - Branch Use Priority
 - Section Rank Priority
 - Major M&R Priority
- **Cost by Condition**
 - Cost by Condition
 - Budget

The screenshot displays the 'FAA PAVEAIR : M&R Consequence of Local Repair' interface. At the top, it shows the 'Open Existing M&R' section with a dropdown for 'M&R Name' (set to 'LGA_CLRTes1'), a 'Database' field (set to 'LGA'), and an 'M&R Type' field (set to 'ConsequenceOfLocalRepair'). Below this is a tabbed interface with 'Scope', 'Timing', 'Options', and 'Result' tabs. The 'Options' tab is active, showing a checkbox for 'Use Assigned M&R Families for Cost and Policies'. The 'Localized' section contains three rows of settings: 'Policy < Critical' with a dropdown for 'LOCALIZED SAFETY FOR AIRFIELDS (DEFAULT)', 'Cost by WorkType' with a dropdown for 'Default Cost by Work Type', and a 'Factor' field set to '1.00'. The 'Policy > Critical' section has similar settings. The 'Policy Consequence' section has a dropdown for 'Localized Policy Consequence (Default)'. Below the main settings, there are three panels: 'FAA PAVEAIR : M&R Tables' with links for 'Edit Localized M&R', 'Edit Global M&R', and 'MR Family'; 'M&R:259:LGA_CLRTes1:' with links for 'Edit Major M&R' and 'Cost by Condition / Budget'; and a 'Cost by Condition / Budget' panel with links for 'Cost by Condition' and 'Budget'.

Supported M&R Types

- **Critical PCI Method**

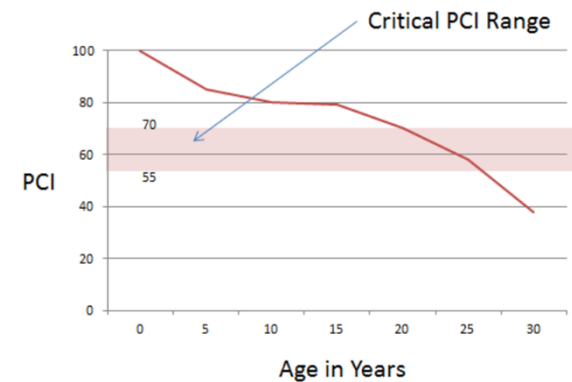
- Critical PCI = PCI value after which a pavement deteriorates rapidly.
- Usually between a PCI number of 55-70.
- More economical to maintain pavements above than below the critical PCI.
- Cost of applying localized preventive maintenance increases significantly.

- **Minimum Condition**

- Only concerned with the Major M&R required to maintain a minimum PCI.
- Major M&R: Any overlay or other major work that results in a PCI of 100.
- Select the lowest pavement condition that is allowed for each pavement rank.
- Prioritize the Maintenance and Repair plan to reflect the choice of “Minimum Condition” as the variable for decision making in regard to future work.

- **Consequence of Local Repair**

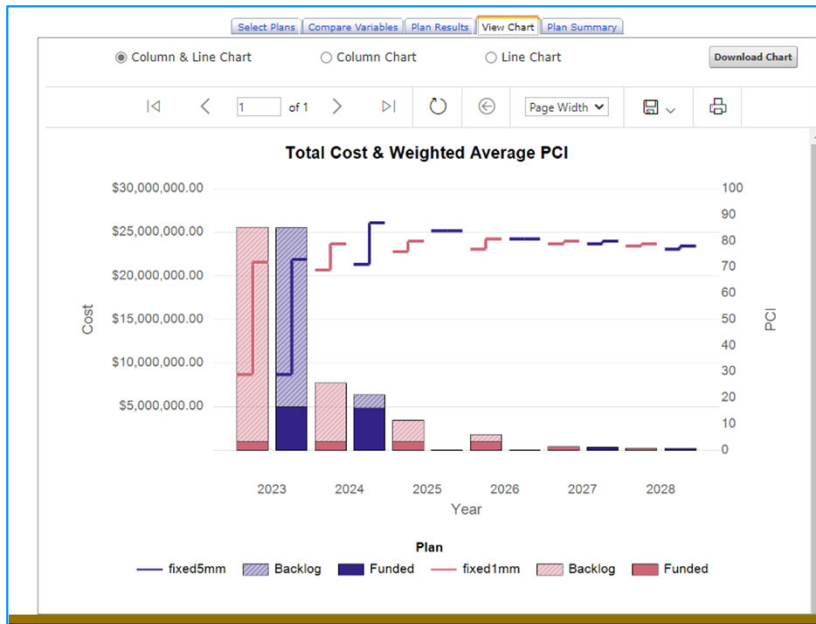
- Calculates the cost and resulting condition from the immediate implementation of local maintenance and repair.
- M&R actions are based on current distresses and their severity.
- Consider this plan mode for pavements above Critical PCI.



M&R Comparison

- Compare cost and resulting condition of multiple M&R plans.
- Tabular and graphical format.

Compare effects of a \$1 million and \$5 million M&R budget:

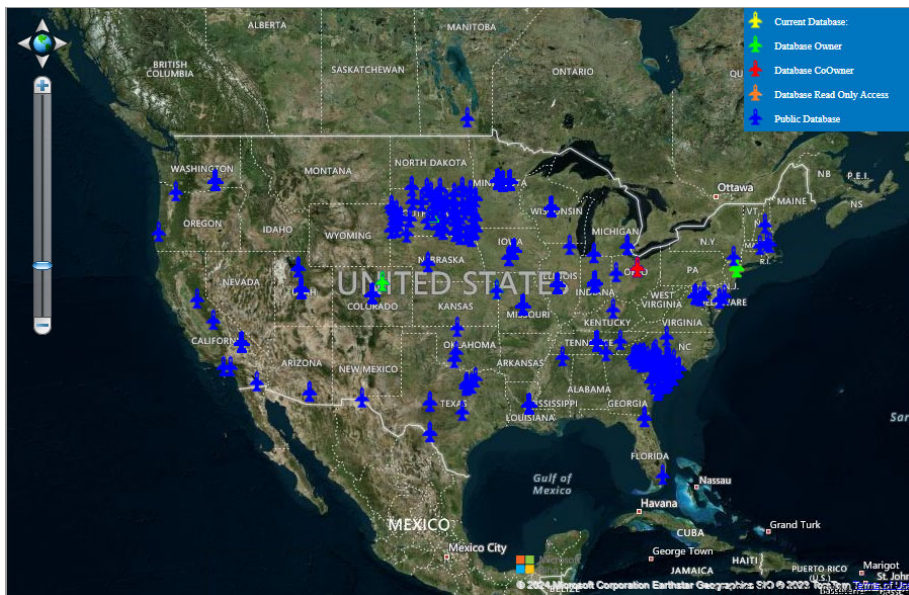


Plan Info			Beginning of Plan	End of Plan
Plan : fixed1mm				
Year			2023	2028
PCI			29	79
Plan : fixed5mm				
Year			2023	2028
PCI			29	78

Plan Parameter	Cost	Area (ft²)	Number of Sections
Plan : fixed1mm			
Stop Gap Funded	1,637,823.50	2,911,700.77	17
Preventive Funded	370,021.17	4,412,754.29	40
Global Funded	72,222.59	1,114,043.79	14
Major Funded	2,519,793.04	437,498.15	11
Total Funded	4,599,860.30	4,412,754.29	40
Last Year Unfunded	0.00	0.00	0
Plan : fixed5mm			
Stop Gap Funded	1,207,408.83	1,794,514.97	9
Preventive Funded	389,471.81	4,412,754.29	40
Global Funded	79,778.06	1,082,543.53	13
Major Funded	8,852,638.31	1,554,683.95	19
Total Funded	10,529,297.01	4,412,754.29	40
Last Year Unfunded	0.00	0.00	0

GIS Mapping Capabilities

Database Locations

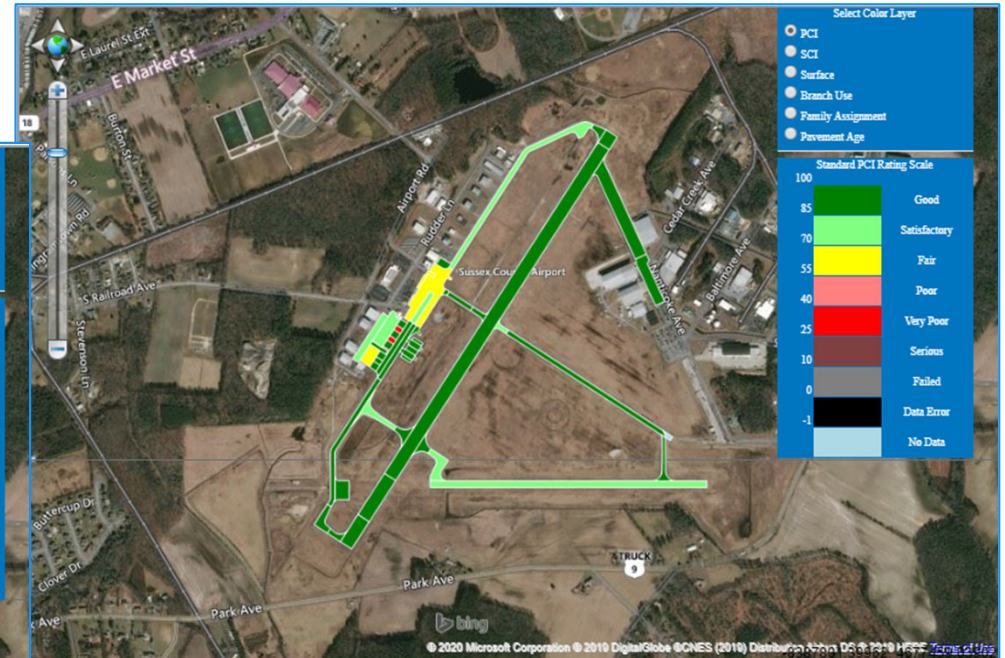
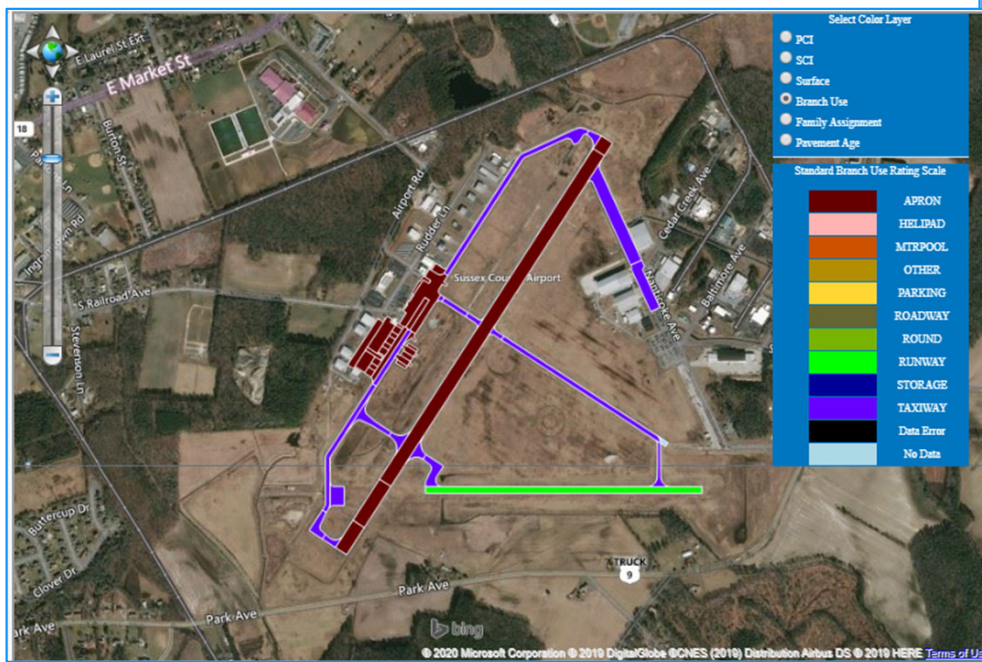


Zoom to Shapefiles



Aerial Photography for GIS

- Free to user.
- PAVEAIR detects if shapefiles are georeferenced and automatically puts them in the correct location.



Branch Use and PCI maps on aerial photography background

Reporting Capabilities

- **Standard Reports**

- **Graphical Summary Reports (customizable)**

FAA PAVEAIR : Reports
Current Database: LGA_2019_TAP

Standard Reports Graphical Summary Reports

LGA_2019_TAP

- Branch List Report
- Work History Report
- Work History Summary Report
- Branch Condition Report**
- Branch Condition Summary Report
- Section Condition Report
- Section Condition Summary Report
- Re-Inspection Report
- Re-Inspection Details Report
- Re-Inspection Summary Report
- Re-Inspection Work History Report

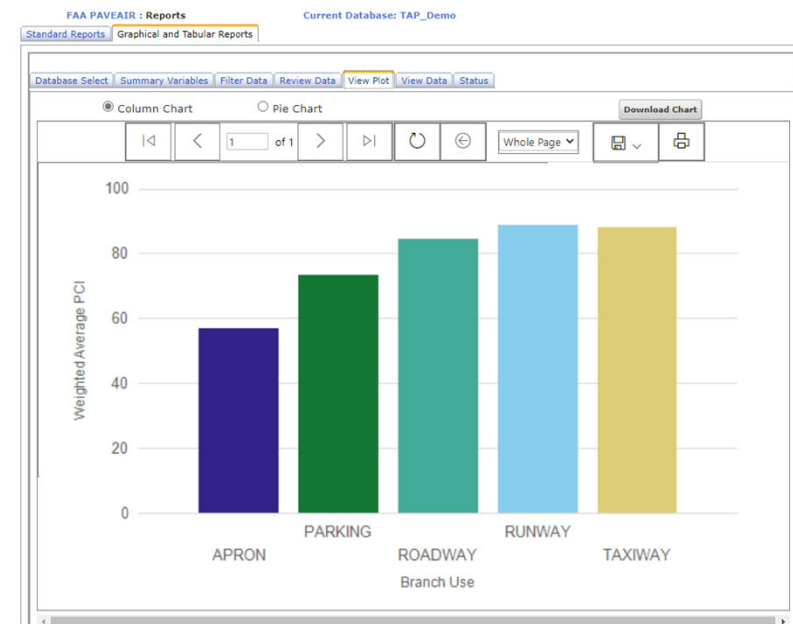
Branch Condition Report

Report Date: 4/10/2024 4:01:53 PM
Parent Database: DemoDC Page 1 of 1

Network	Branch	Number of Sections	Run Section Length (ft)	Run Section Width (ft)	Total Area (ft²)	Branch Use	Average PCI	PCI Standard Deviation	Weighted Average PCI
APRON	APRON	1	200.00	100.00	20,000.00	APRON	52	5	52
ROADWAY	ROADWAY	2	100.00	100.00	20,000.00	ROADWAY	65	1	65
TAXIWAY	TAXIWAY	2	100.00	100.00	20,000.00	TAXIWAY	71	2	72

Branch Condition Summary Report

Use Category	Number of Sections	Total Area (ft²)	Arithmetic Average PCI	Standard Deviation PCI	Weighted Average PCI
APRON	1	20,000.00	52.00	5.00	52.00
ROADWAY	2	40,000.00	65.00	0.71	66.25
TAXIWAY	2	40,000.00	71.00	2.21	71.75
All	5	1,175,000.00	70.31	2.20	70.37



Life Cycle Cost Analysis (LCCA)

- Implements the AAPTTP AirCost LCCA Application
- Economic Analysis - evaluates the long-term economic benefit among different pavement design strategies.
- Procedures
 - Establish alternative pavement design strategies
 - Determine the performance period and activity timing
 - Estimate costs
 - Compute Net Present Value (NPV)
 - Analyze results
 - Re-evaluate pavement design strategies

LCCA Parameters	
Analysis Base Year:	2011
Initial Construction Year:	2011
Analysis Period:	50
Salvage Value:	<input checked="" type="checkbox"/> Prorated Life
Administrative Cost (%):	5.00
Engineering Cost (%):	5.00
Maintenance of Traffic Cost (%):	5.00
Edit	



NOAA Weather Data Access

New!

Network Details

Network Name: MansfieldLahm

Comment:

Airport Code: MFD

Country: --Select Country--

State: --Select State--

Latitude (Decimal Degrees):

Longitude (Decimal Degrees):

Airport Type:

Climate Zone:

Save Cancel

Set airport code for network
in Inventory Update

Measurement	Value
Network	ATL
Start Date	Thursday, January 1, 2015
End Date	Thursday, December 31, 2015
Completeness	8,758 of 8,760 hours contained data (i.e., completeness percentage - 99.98%)
Temperature High	95.00 F
Temperature Low	10.94 F
Temperature Average	64.16 F
Average Daily Temperature Range	16.87 F
Freeze Thaw	22 freeze-thaw cycles
Freeze Degree Days	34.10 F
Days Temperature Was Over 90	35 days
Days With Precipitation	146 days
Average Duration of Precipitation	2.26 hours
Precipitation Total	68.82 inches
Thornthwaite	104 %
Relative Humidity High	100.00 %
Relative Humidity Low	5.81 %
Relative Humidity Average	60.41 %
Hydration Days	222 days
Sky Cover	5.08 oktas
Solar Radiation	N/A
Wind Average	7.58 mph
Days With Freeze Precipitation	1 day

Runway Usage (Traffic) Data **New!**

(U.S. Only)

FAA PAVEAIR : Member Area : Inventory Current Database: TAP_man_B

Select Network MansfieldLahm Add New Edit Delete

Branch Name	Branch Use	True Area	Edit	Delete
14-32	RUNWAY	1,432,950.00	Edit	Delete
05-23	RUNWAY	936,750.00	Edit	Delete
TWY	TAXIWAY	1,632,503.00	Edit	Delete
RUNUP AREA	APRON	62,000.00	Edit	Delete
T/HANGAR	TAXIWAY	30,815.00	Edit	Delete
APRON	APRON	317,699.50	Edit	Delete

[Add New Branch Data](#)

From	To	North/East End	South/West End	Current	Comments	Edit	Delete
1/1/2010		14	32			Edit	Delete

[Add New End Data](#)

Enter runway designators
per runway branch

Current Database: ATL

Network ATL Branch RW09L-27R 09L

Start Date Year Month 2020 1

End Date Year Month 2020 12

Earliest Available Date: 06/2014

Latest Available Date: 08/2022

Filter

[Show Help](#)

☒ Both ☐ C27R ☐ O9L

[Run Query](#)

Aircraft	Arrivals	Departures
A320	40	4977
A321	61	10070
B733	0	1
B734	1	3
B737	108	10748
B738	89	9325
B739	39	11105

Data shown represents 277 days of data between 1/1/2020 and 12/1/2020 (75.7% complete between requested dates 1/1/2020 and 12/31/2020).

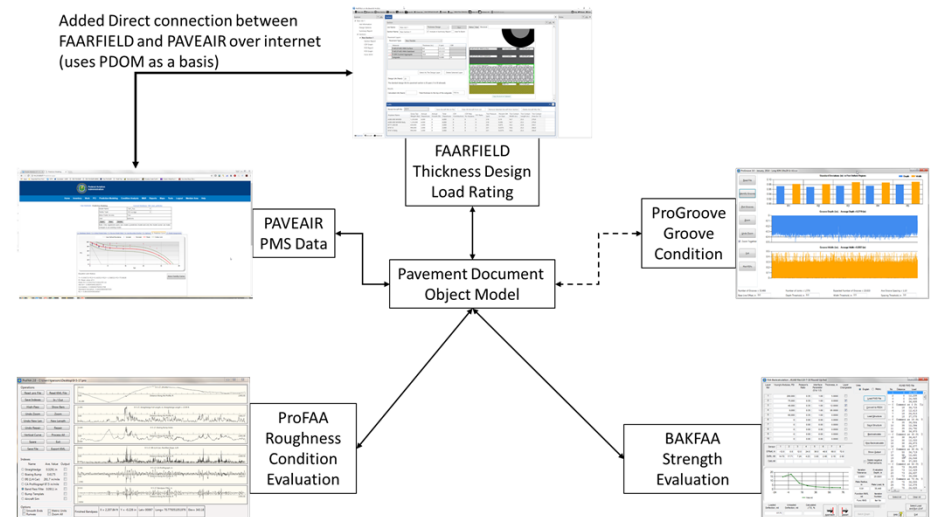
Software Integration

- FAA has five software programs required or recommended for use by FAA AC's: FAARFIELD; PAVEAIR, BAKFAA, ProFAA, ProGroove.
- Developed separately, they each had a unique data format and user experience.
- Data types overlap between the applications.

Examples:

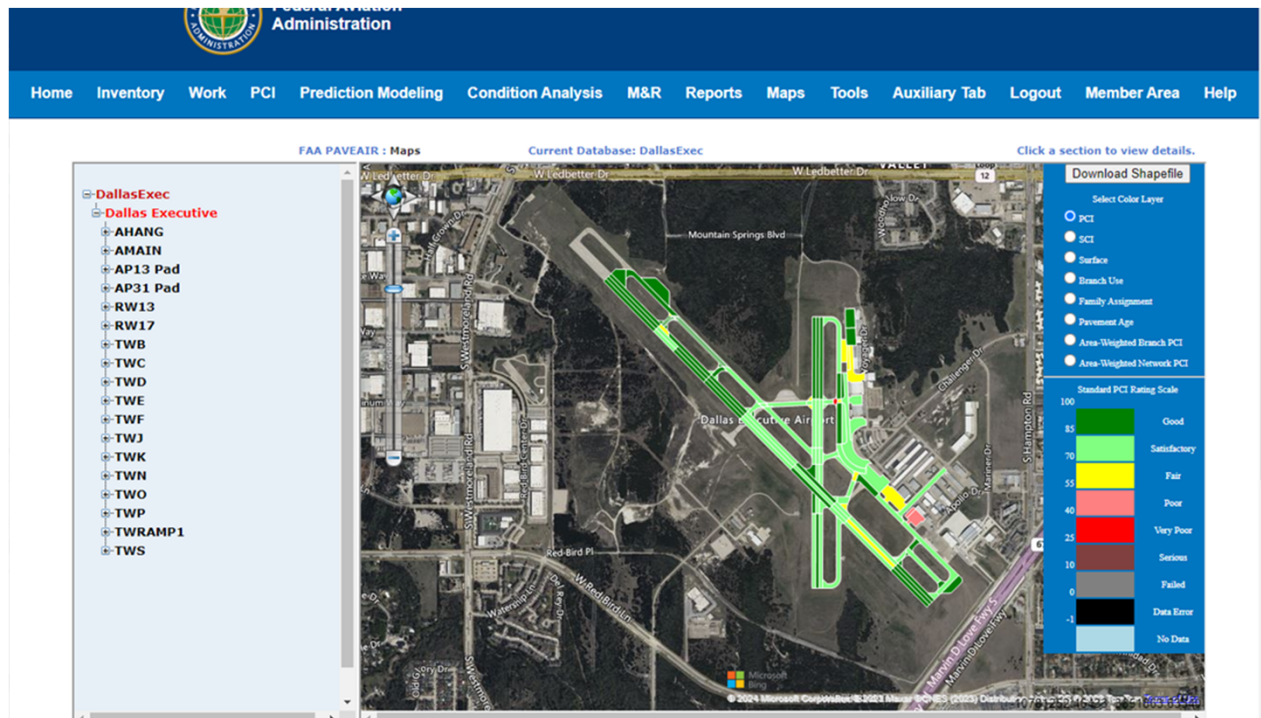
- FAARFIELD uses moduli determined in BAKFAA.
- PAVEAIR LCCA uses layer thicknesses determined in FAARFIELD.

- **PDOM allows any FAA pavement application to read the data file from any other.**
 - Ease of use.
 - Minimize transcription errors.
 - One file contains full pavement history (design, as-constructed, condition, roughness, NDT, M&R plans).



Pavement Document Object Model (PDOM)

The PDOM is a common data format readable by any FAA pavement software. It can be stored as a file or transmitted over the network.



FAA PAVEAIR 3.7 Demonstration

<https://faapaveair.faa.gov/>



Looking Ahead: UAS for Pavement Inspections

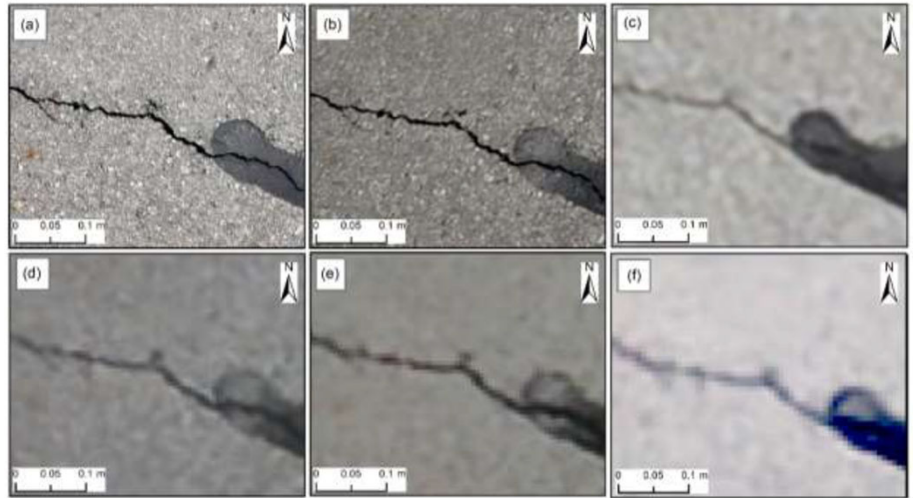
UAS/sUAS Integration at Airports

- Uncrewed aircraft systems (UAS) are increasingly popular in recreational, commercial, and public safety settings.
- The FAA William J. Hughes Technical Center is collaborating with the FAA's Office of Airports to support the reliable, safe, and effective integration of small UAS (sUAS) into the airport environment for:
 - Pavement Inspections
 - Construction Monitoring
 - Obstruction Analysis
 - Perimeter Fenceline Inspections
 - Wildlife Dispersal
 - Foreign Object Damage (FOD) Detection
 - Aircraft Rescue and Firefighting (ARFF)



sUAS for Pavement Inspections

- **Purpose:** Evaluate the use of sUAS to conduct airport pavement inspections.
- **Research Lifecycle:** 2020 - 2022
 - Tested at eight airports with different pavement types/severities.
 - Tested various types of sUAS and optical cameras.
 - UAS data was compared to traditional 'foot-on-ground' surveys.
- **Finding:** sUAS are a suitable tool for supplementing, but not replacing traditional foot-on-ground pavement inspections.
- **Reports:**
 - **DOT/FAA/TC-22/48**, Practical Lessons Learned from Planning, Collecting, Processing, and Analyzing Small Unmanned Aircraft System Data for Airfield Pavement Inspection (2022)
 - **DOT/FAA/TC-23/39**, Assessment of Small Unmanned Aircraft Systems for Pavement Inspections (2023)
 - **DOT/FAA/TC-23/50**, Small Unmanned Aircraft System for Pavement Inspection (2023).



Contact: Matthew Brynick, Matthew.T.Brynick@faa.gov

Thank You!

Acknowledgments:

FAA Airport Technology R&D Branch:
James Layton, Branch Manager;
Murphy Flynn, Airport Pavement Section Manager
Qingge (Quinn) Jia, Project Manager

FAA Airport Engineering Division:
D'Lorah Small, Harold Honey, Jeff Crislip, Harold Muniz-Ruiz

ARA:
Tim Parsons; Richard Speir; Marti Denis



david.brill@faa.gov

qingge.jia@faa.gov

<https://airporttech.tc.faa.gov>