

# FAA PAVEAIR

## Web-Based Airport Pavement Management System

Presented to: SWIFT 2011 Conference

By: Gordon Hayhoe, FAA Airport Technology R&D Team

Venue: Delta Centre Ville, Montreal, Canada

Date: September 14, 2011



**Federal Aviation  
Administration**





# Outline

- Getting started with FAA PAVEAIR.
- FAA sponsorship of airport pavement data management software applications.
- Development, specifications, and current status of the new Web-based airport pavement data management system called PAVEAIR.
- Integration of FAA pavement design and evaluation software applications.



# FAA PAVEAIR Opening Page



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FAA PAVEAIR

Current Database: ALDATA

## 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) 150.5380-7A.

FAA PAVEAIR is a pavement management system intended for use by airport pavement engineers, airport management, cost accounting professionals charged with determining the most accurate PCI as a basis for maintaining the safest possible airport pavement quality within acceptable cost constraints and time horizons.

If you have comments or issues with this software program, please contact the FAA PAVEAIR team. [Albert Larkin](#) or [Qingge Jia](#).

Visit [News](#) page for Latest News and Events.

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Password:

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### Databases

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


Select a Database

FAA PAVEAIR Version 1.3.10 build 2011.06.28 - [View Change Log](#)

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# Getting Started - Registration

**FAA PAVEAIR**

 Federal Aviation Administration

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**FAA PAVEAIR : PAVEAIR Registration** **Current Database: ALDATA**

**User Information**

First Name:

Last Name:

Title:

Organization:

Address Line 1:

Address Line 2:

City:

State: ALABAMA

Zip:

Country:

Phone:

Fax:

Email:


Preferred Contact Method: Email

Select "Other" if not in the US

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# Workshop and User's Group

 Federal Aviation Administration

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Current Database: ALDATA

**News and Events**  
[Register](#)

**FAA PAVEAIR Workshop / User's Group Meeting**  
9/14/2011 8:00:00 AM - 9/15/2011 4:00:00 PM  
Nashville, TN  
[Nashville Airport Marriott](#)  
600 Marriott Drive · Nashville, Tennessee 37214 USA  
Phone: (615) 889-9300

The Federal Aviation Administration (FAA) is pleased to announce that a FAA PAVEAIR Workshop and the first annual FAA PAVEAIR User's Group Meeting will be held in conjunction with the National Association of State Aviation Officials (NASAO) Conference at the Nashville Airport Marriot.

The four hour workshop will be held on Wednesday, September 14th beginning at 8:00 a.m. In the afternoon, we will begin the User's Group meeting to solicit comments, questions, and suggestions on the future development of FAA PAVEAIR; the User's Group meeting will continue and conclude on Thursday, September 15.

There is no additional cost nor do you need to attend the NASAO Convention to participate in the FAA PAVEAIR Workshop or User's Group Meeting.

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# FAA Contact Information

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Phone: (609) 485-5427
3. PAVEAIR Beta website: <http://www.faapaveair.faa.gov>
4. AJP-6312 website: <http://www.airporttech.tc.faa.gov>



# Mainframe and Micro Paver

- Development of Mainframe PAVER was started in 1968 for use on mainframe computers.
- Development was by the United States Army Corps of Engineers (ACOE) for use by the Department of Defense (DOD).
- Development of Micro PAVER was started in 1985 for use on microcomputers.
- Funding was by the FAA and development by the ACOE.



# Micro PAVER Base Functionality

- The FAA version of MicroPAVER had the following functions:
  - Divide airport pavements into uniform sections to comply with the existing FAA pavement management Advisory Circular.
  - Store the pavement condition history in accordance with the Pavement Condition Index (PCI) method.
  - Store pavement construction and maintenance history.
  - Store deflectometer test results for overlay design.
  - Generate network level reports for planning, budgeting, inspection scheduling, and pavement condition at any time.
  - Provide project level analysis for maintenance and repair (M&R) requirements and perform economic analyses for different M&R alternatives.



# AC 150/5380-7 and -7A

- Micro Paver was delivered in 1987.
- AC 150/5380-7 “Airport Pavement Management System” was issued September 28, 1988.
- AC 150/5380-7A “Airport Pavement Management Program” was issued September 1, 2006.



# Requirement for Pavement Management Programs on AIP Projects

- Public Law 103-3055, Section 107, amended Title 49, Section 47105 of the United States Code (1995).
  - To be eligible for federal funding, an airport agency must implement an effective pavement maintenance management program.



# AC 150/5380-7A Recommends PMS Software



U.S. Department  
of Transportation  
Federal Aviation  
Administration

## Advisory Circular

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Subject: AIRPORT PAVEMENT MANAGEMENT PROGRAM	Date: 9/01/06	AC No: 150/5380-7A
	Initiated by: AAS-100	Change:

---

### 1. PURPOSE OF THIS ADVISORY CIRCULAR.

This advisory circular (AC) discusses the Airport Pavement Management System (APMS) concept, its essential components, and how it can be used to make cost-effective decisions about pavement maintenance and rehabilitation.

### 2. WHAT THIS AC CANCELS.

This AC cancels AC 150/5380-7, Pavement Management System, dated September 28, 1988.

### 3. WHO THIS AC AFFECTS.

This AC is intended for the airport operators, engineers, and maintenance personnel responsible for implementing an airport pavement management system.

### 4. COMMENTS OR SUGGESTIONS.

Send comments or suggestions for improving this AC to—

Manager, Airport Engineering Division  
Federal Aviation Administration  
ATTN: AAS-100  
800 Independence Avenue SW  
Washington DC 20591

### 5. COPIES OF THIS AC.

The Office of Airport Safety and Standards makes its ACs available online at [http://www.faa.gov/airports\\_airtraffic/airports/resources/advisory\\_circulars/](http://www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/).

David L. Bennett  
Director, Office of Airport Safety and Standards

### 4.0 MICRO PAVER™ AND OTHER COMMERCIAL PMS SOFTWARE.

When developing an APMS, airports can make use of several existing software options. Micro Paver™ is a pavement management system (PMS) application being used by airport pavement networks at the state and local level. The U.S. Army Construction Engineering Research Laboratory under contract to the Federal Aviation Administration developed this computer program. The program has been continually updated by the FAA, Federal Highway Administration, U.S. Corp of Engineers, U.S. Air Force, U.S. Navy, and other authorities to meet the needs of current users. In addition, various consulting firms have developed similar software using the concept originally developed in Micro Paver™.

PMS software allows for storage of pavement condition history, nondestructive testing data, and construction and maintenance history, including cost data. It provides many capabilities, including evaluation of current conditions, prediction of future conditions, identification of maintenance and rehabilitation needs, inspection scheduling, economic analysis, and budget planning. PMS software not only evaluates the present condition of the pavement using the PCI system described in *ASTM D 5340*, but can also predict its future condition.

Note: The PCI is a numerical indicator that reflects the structural integrity and surface operational condition of a pavement. It is based on an objective measurement of distress type, severity, and quantity. By projecting the rate of deterioration, a life-cycle cost analysis can be performed for various M&R alternatives. Not only can the best alternative be selected, but the optimal time of application can also be determined.



# AC 150/5380-7A Recommends PMS Software

## 4.0 MICRO PAVER™ AND OTHER COMMERCIAL PMS SOFTWARE.

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# PAVEAIR Background

- A joint initiative between the FAA and the National Association of State Aviation Officials (NASAO) to develop a system for sharing information to optimize the expenditure of funds.
- Formal Memorandum of Understanding between the FAA and NASAO.
- An Internet (Web) based system was deemed to be the best option considering the mature status of web-based applications.



# PAVEAIR Background

- The FAA also has a need for system-wide dissemination and analysis of the performance of FAA sponsored pavement projects, making a web-based version the best option.
- A collection of airport pavement design and evaluation computer programs has also been developed and a dedicated PMS software application would tie these programs together.





# PAVEAIR Background

- Development was started in 2008.
- Developer was, and continues to be, SRA International, Inc., the AJP-6310 support contractor.
- Subcontractors and consultants where additional expertise needed.
- A public beta version was released in February 2011 after internal alpha testing.
- Source code will be made available when the full public version is released in the first quarter of 2012 (planned).



# Possible PAVEAIR Implementations

- By the FAA for AIP projects on a single server.
- By FAA regions for small airports.
- By state DOT's for GA airports (NASAO interest).
- By consulting and engineering services companies for private or customer only access.
- Stand-alone, single PC use.
- Continue to support the program and add functionality.



# PAVEAIR Specifications

- Web-based application that provides a system for easy dissemination of information for airport pavement construction, maintenance, and management.
- Data for multiple airports separately available on a single server connected to the Internet.
- Also suitable for installation and use on:
  - Single PC,
  - Private network,
  - Intranet.

# PAVEAIR Specifications, cont.

- Provide the same functionality as Micro PAVER 5.3 and import e60 database files.
- Default (internal) metric units with optional English units.
- Make the complete application available for free download:
  - As a set of installation files.
  - Full source code.
  - Documentation for installation and operation.



# PAVEAIR Specifications, cont.

- Fully compliant with ASTM D 5340-10
- Microsoft SQL Server database engine.
- XML the default external file format.
- Develop from the ground up as a new application in Microsoft Visual Studio ASP.NET and Visual Basic.NET.
- Use standard Microsoft controls and user interface elements whenever possible.



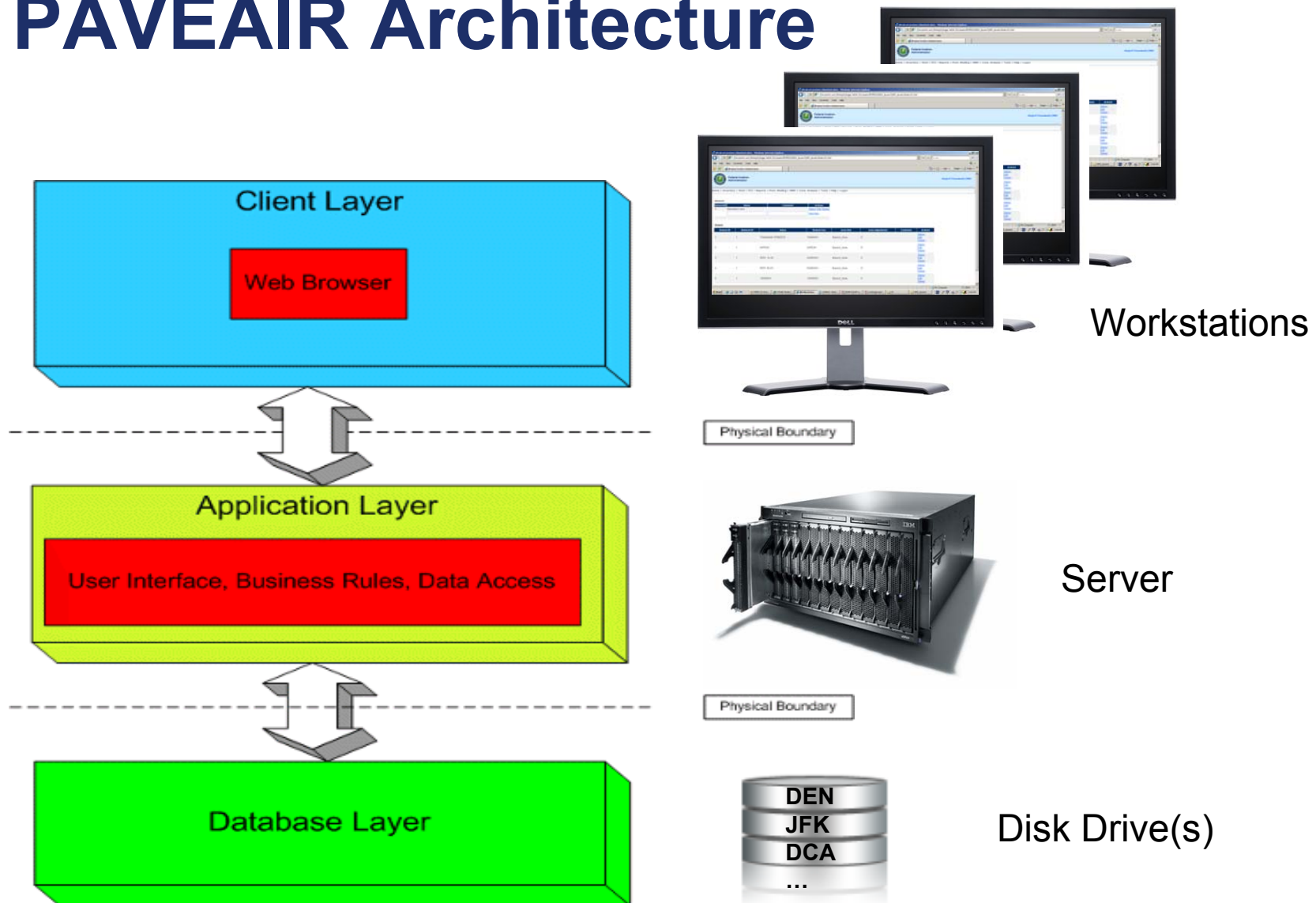
# PAVEAIR Specifications, cont.

- Fully compliant with ASTM D 5340-10.
- Fully compliant with FAA Information Technology requirements for government hosted websites.
  - User interface templates.
  - Accessibility.
  - Registration.

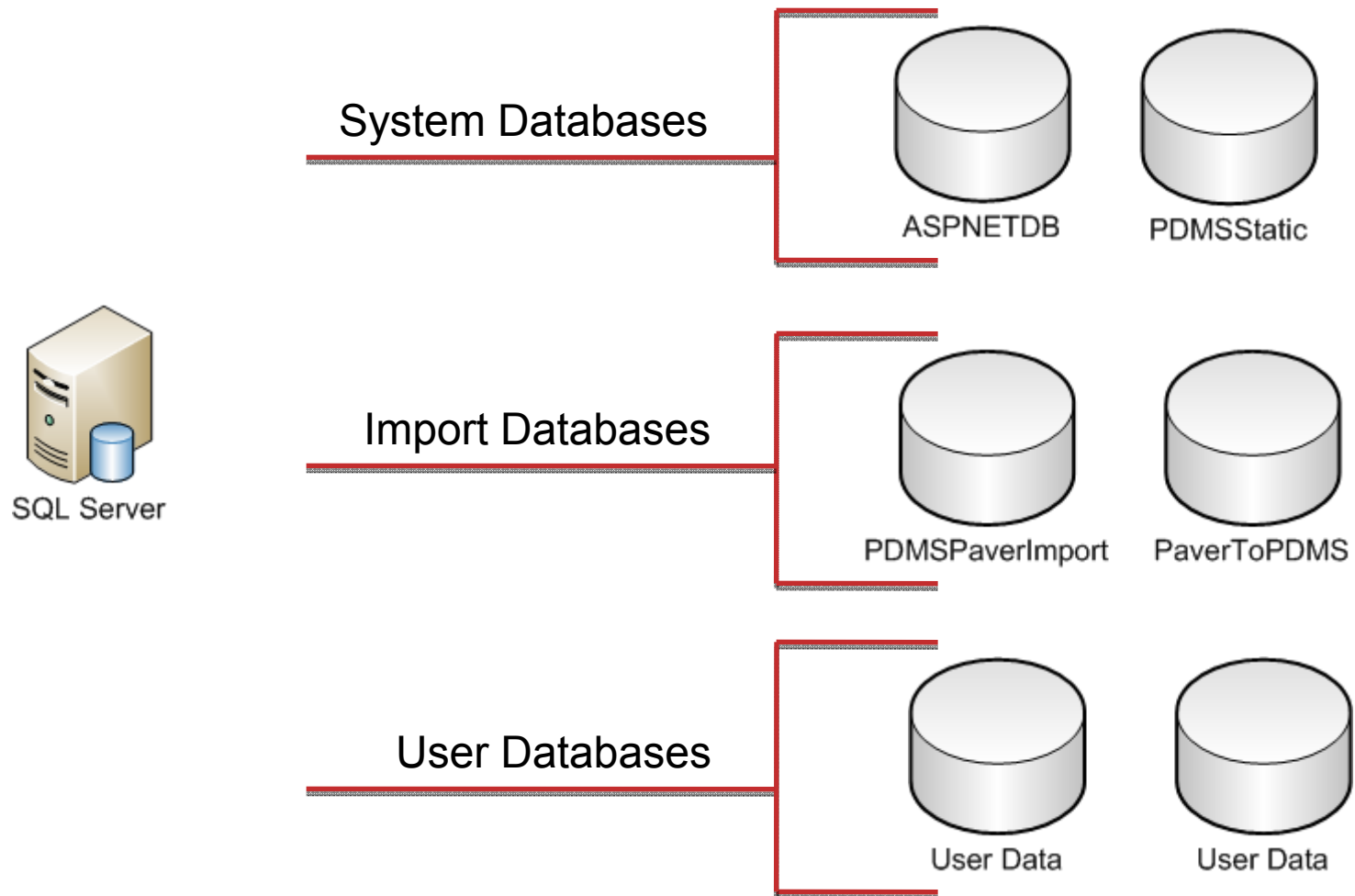




# PAVEAIR Architecture



# Database Architecture



# ASPNETDB

- Created by the Microsoft ASP.NET Logon Control
- Authentication and authorization
- Stores user information, session variables, session states, etc.
- Uses ASP.Net Logon control
- Uses ASP.Net Create User Wizard
- Uses ASP.Net Reset password, change password controls
- Uses ASP.Net Logon View control
- Uses ASP.Net Membership provider
- Uses ASP.Net Profile provider



# Membership Configuration in Web.Config. (fields are set by the database administrator).

```
<connectionStrings>
  <add name="PDMSASPNET" connectionString="Data Source=PAVEMENTS;
    Initial Catalog=ASPNetDB;Integrated Security=True" />
  ...
</connectionStrings>
<membership defaultProvider="PDMSMember" >
  <providers>
    <add name="PDMSMember"
      type="System.Web.Security.SqlMembershipProvider"
      connectionStringName="PDMSASPNET"
      enablePasswordRetrieval="false"
      enablePasswordReset="true"
      requiresQuestionAndAnswer="true"
      applicationName="/" requiresUniqueEmail="false" passwordFormat="Hashed"
      maxInvalidPasswordAttempts="5" minRequiredPasswordLength="6"
      minRequiredNonalphanumericCharacters="0" passwordAttemptWindow="10"
      passwordStrengthRegularExpression="" />
  </providers>
</membership>
```



# PDMStatic

- Stores top level configuration data.
- PCI categories, colors, pavement roughness categories, etc.



# Databases: Import

- Compatible with MicroPAVER.
  - Able to import Micro Paver e60 file.
  - Able to import Micro Paver MDB file.
- Import Steps:
  - Data is uploaded into PDMSPaverImport.
  - Data is converted and temporally stored in PaverToPDMS.
  - Data is then copied to a new PAVEAIR database.



# PAVEAIR User Databases

- A User Database is created for each Inventory (data owner).
- Logically divided into Networks, Branches, and Sections.
- All work is performed on individual sections.
- The database engine is Microsoft SQL Server.



# Microsoft SQL Server

- Six Versions.
  - Workgroup, Standard, and Enterprise (\$750 to \$9,000 and up depending on the number of client licenses)
  - Compact, Express, and Developer (free, free, and \$49)
- The first three are intended for medium-to-large Internet-connected applications.
- The second three are intended for small Internet-connected applications and for single-user stand-alone applications

# Microsoft SQL Server, cont.

- The single-user version of PAVEAIR uses SQL Server Express Edition as the default.
- Use on a single PC requires the installation of Microsoft Internet Information Services (IIS), available free.
- SQL Server Express is a component of the Microsoft Framework and is installed with the operating system for Windows XP and Vista.

# FAA Compliance Requirements

- Use of FAA approved page and form templates and request for waivers.
  - Modifications required for some UI components, such as menu bar.
  - Modifications to be documented and justification provided.
- Registration of web application with the FAA IT organization.



# U.S. Government Section 508 Accessibility Requirements

- **§ 1194.1 Purpose.**

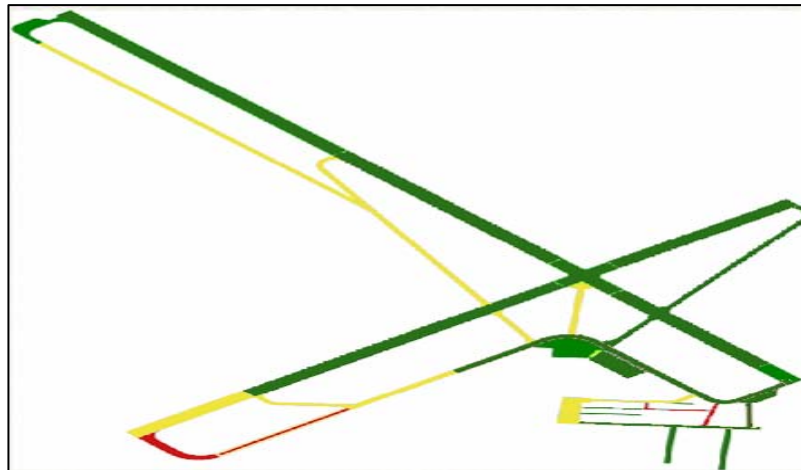
- The purpose of this part is to implement section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794d). Section 508 requires that when Federal agencies develop, procure, maintain, or use electronic and information technology, Federal employees with disabilities have access to and use of information and data that is comparable to the access and use by Federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the agency. Section 508 also requires that individuals with disabilities, who are members of the public seeking information or services from a Federal agency, have access to and use of information and data that is comparable to that provided to the public who are not individuals with disabilities, unless an undue burden would be imposed on the agency.

# Section 508 Accessibility Requirements

- Text equivalent for non-text elements.
- Information conveyed with color is also available without color.
- Table Row & Column headers should be identified.
- Using automatic Compliance Check Tools.
  - Accessibility Checker (Visual Studio & Expression Web)
  - Fangs (a screen reader emulator).
  - Online Web Accessibility Initiative Checker.



# Section 508 Accessibility Requirements

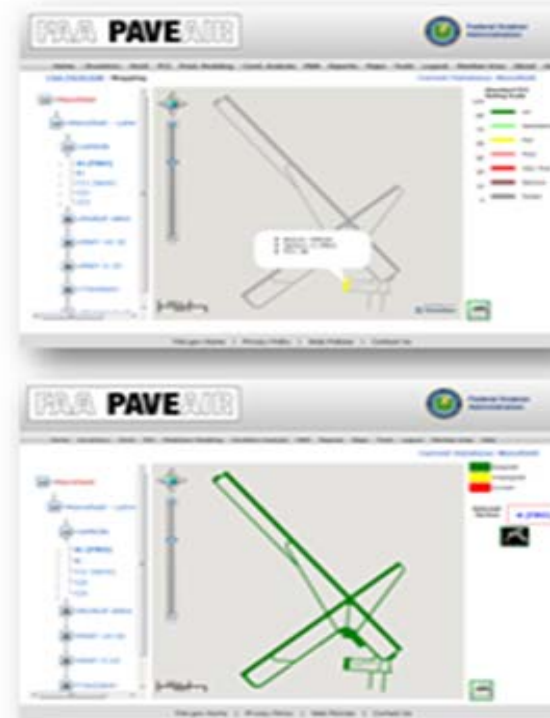


Unacceptable without an alternative shaded version or mouse-over text descriptions of the color code.

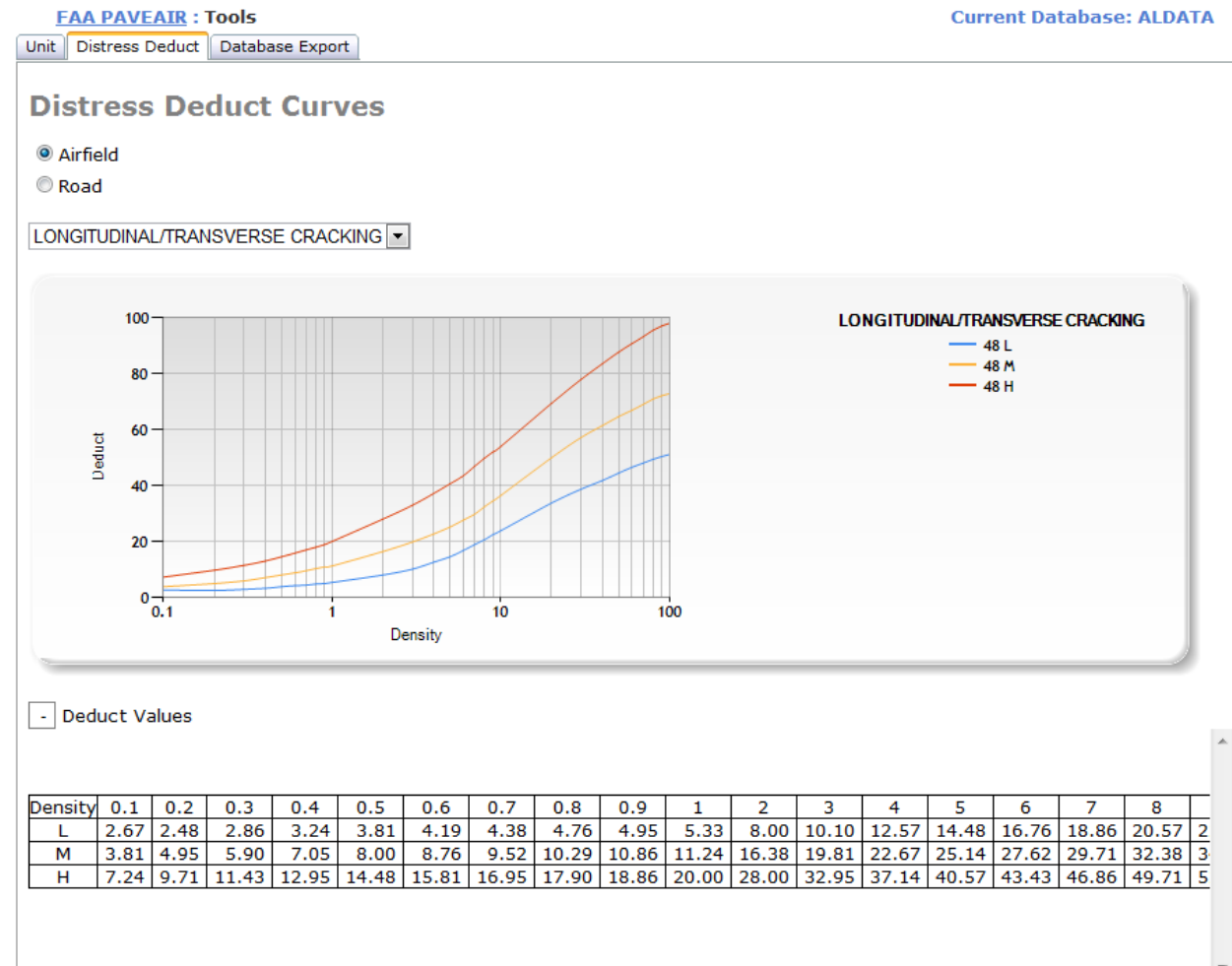
# From the Workshop Workbook

# Mapping

- Add a shape file to the current database
  - Use the “Upload Shapefiles to Current DB” tool
- Import a shape file from MicroPAVER
  - Shapefiles are imported with MicroPAVER data
- Shape file assignment tool
  - Allows the assignment of pavement sections to shape file objects



# Distress Deduct Curves



# Current Status of PAVEAIR

- Beta version available at <http://faapaveair.faa.gov/>.
- Download of full installation files and source code first quarter 2012.
- Continue with workshops and user's group meetings (check "News").
- Add life cycle cost function.

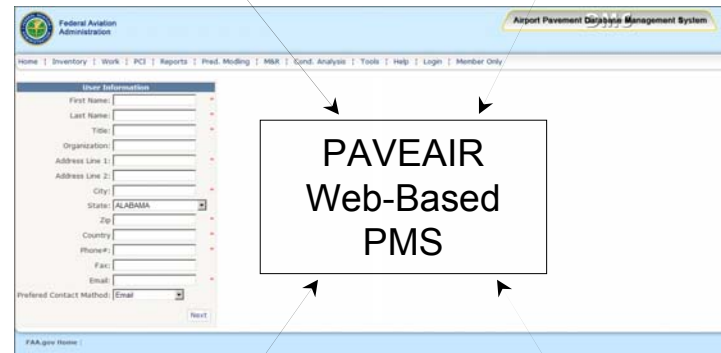
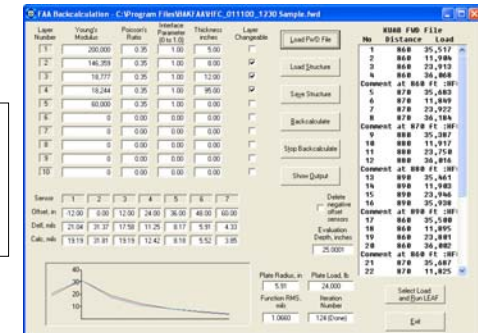


# FAA Pavement Software Applications

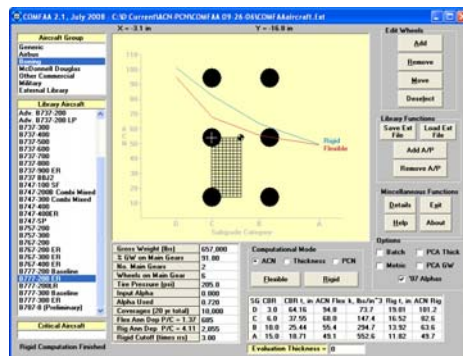


FAARFIELD  
Thickness  
Design

BAKFAA  
Strength  
Evaluation

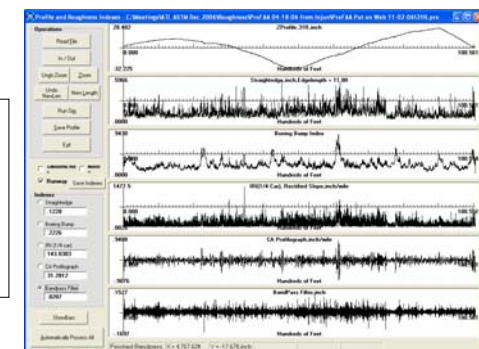


PAVEAIR  
Web-Based  
PMS



COMFAA  
PCN Load  
Rating

ProFAA  
Roughness  
Condition  
Evaluation



PAVEAIR – Swift Conference  
September 14, 2011



Federal Aviation  
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# Software Categories

- **Pavement Thickness Design.**

- LEDFAA – layered elastic design model (AC 150/5320-6D).
- FAARFIELD – layered elastic and finite element design models (Draft AC 150/5320-6E).
- COMFAA – CBR and Westergaard design models (AC 150/5320-6D).

- **Pavement Load Evaluation.**

- COMFAA – ACN-PCN analysis (AC 150/5335-5A).

- **Pavement Condition Evaluation.**

- BAKFAA – backcalculation of layer properties with layered elastic model (AC 150/5370-11A).
- ProFAA – pavement profile analysis and roughness index calculation (Draft AC 150/5380-9).

# Software Categories

- **Pavement Response Analysis.**

- LEAF – layered elastic model, BAKFAA is the user interface.
- FEAFAA – finite element model, stand alone user interface.

- **Pavement Data Management.**

- PAVEAIR – internet-based database management system currently under development.
- The first version will have the same functionality as Micro PAVER 5.3.
- Subsequent development will expand the pavement management functionality and integrate the pavement design and evaluation tools listed above.

# Integration of the Software Applications?

- Current attempts at integrating the different applications is to
  - Make the file formats compatible, and all XML.
  - Launch other applications from PAVEAIR.
  - But maintain stand-alone versions of the design and evaluation programs.
- Tighter integration is not currently planned but may be possible within 5 years.



# FAA Contact Information

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