

R&D Update from the National Airport Pavement Test Facility

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Federal Aviation
Administration



Airport Technology R&D Program

- **Introduction**
- **Full Scale Testing**
- **Software**
- **Research Projects**
- **Facility Upgrades**
- **Up Coming Events**



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Federal Aviation Administration

Airport Technology R&D Program

- **Research conducted at the FAA William J. Hughes Technical Center, Atlantic City, NJ, USA.**
- **Sponsor: FAA Office of Airport Safety and Standards (AAS100), Washington, DC.**
- **Provide support for development of FAA pavement standards (Advisory Circulars).**



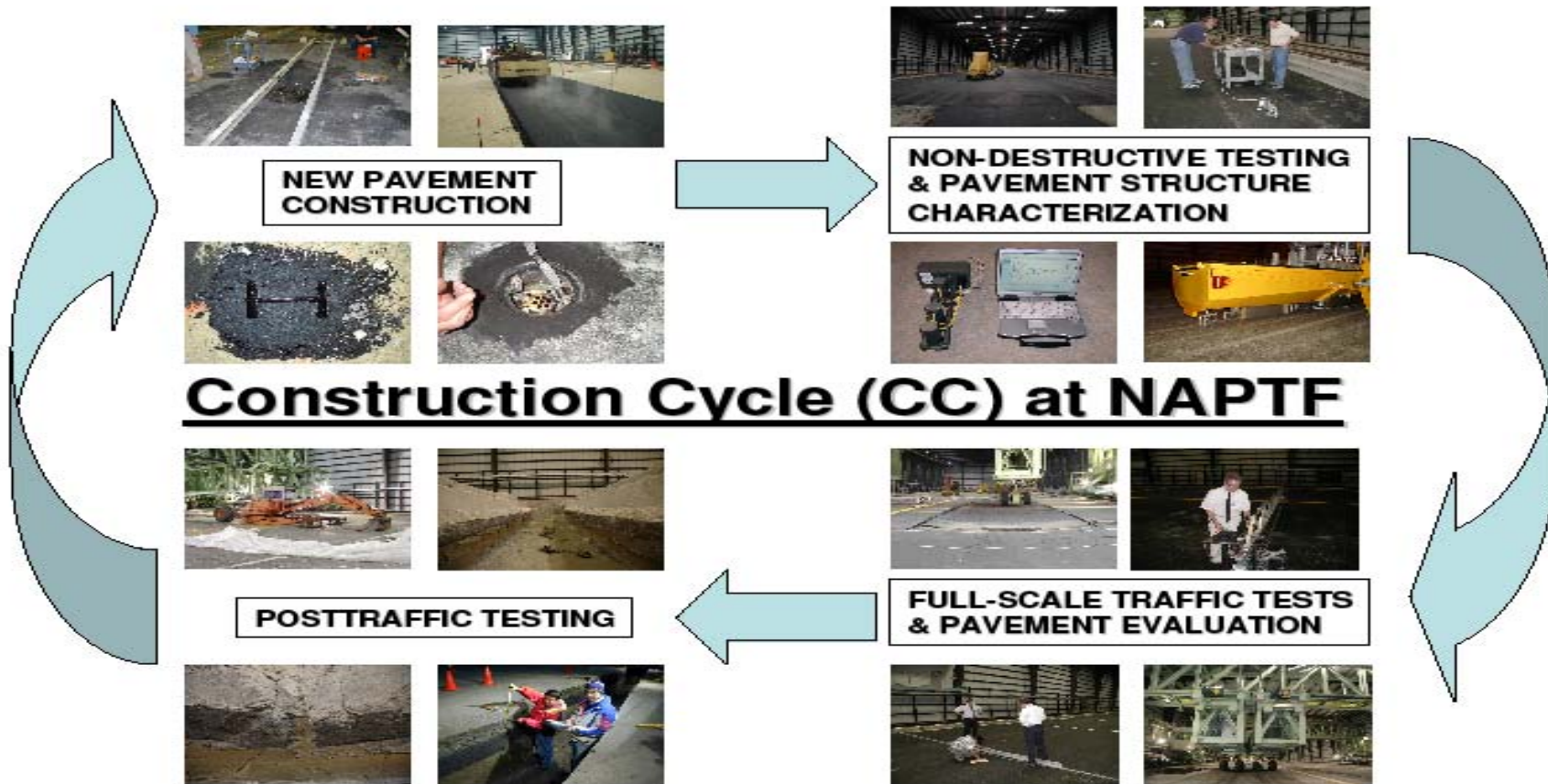
National Airport Pavement Test Facility (NAPTF)

FACTS:

- Fully enclosed facility for accelerated traffic testing of airport pavements.
- Full-scale pavement structures and landing gear loads with programmed wander.
- Opened in 1999.
- Total construction contract was \$21M.
 - \$14M from FAA
 - \$7M from Boeing Co. under FAA/Boeing CRDA.



NAPTF Construction Cycle (CC)



Full Scale Testing

Construction Cycle 5 (CC5) – Flexible Pavement

- **Objectives**

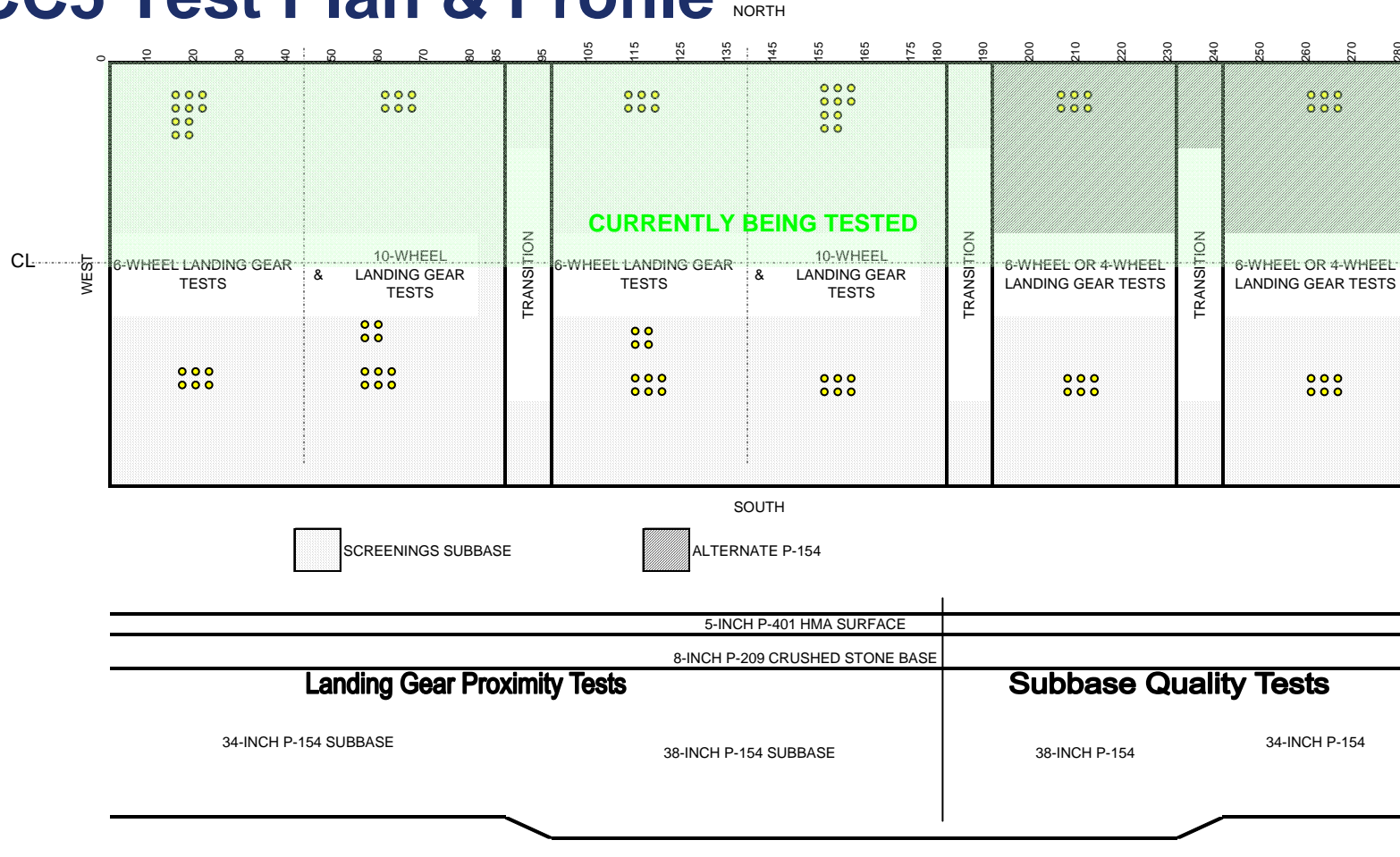
- Determine the effect of gear interaction on low-strength subgrade flexible pavement life.
- Study the Performance of different quality subbase materials.

- **History**

- Construction Completed: July 14, 2008
- Started Loading: August 14, 2008
- Increased wheel load from 50k to 58k: October 7, 2008
- Cold Weather Shut Down: November 12, 2008
- 12,276 passes restart
- Restarted testing on Sept 1st at 65k



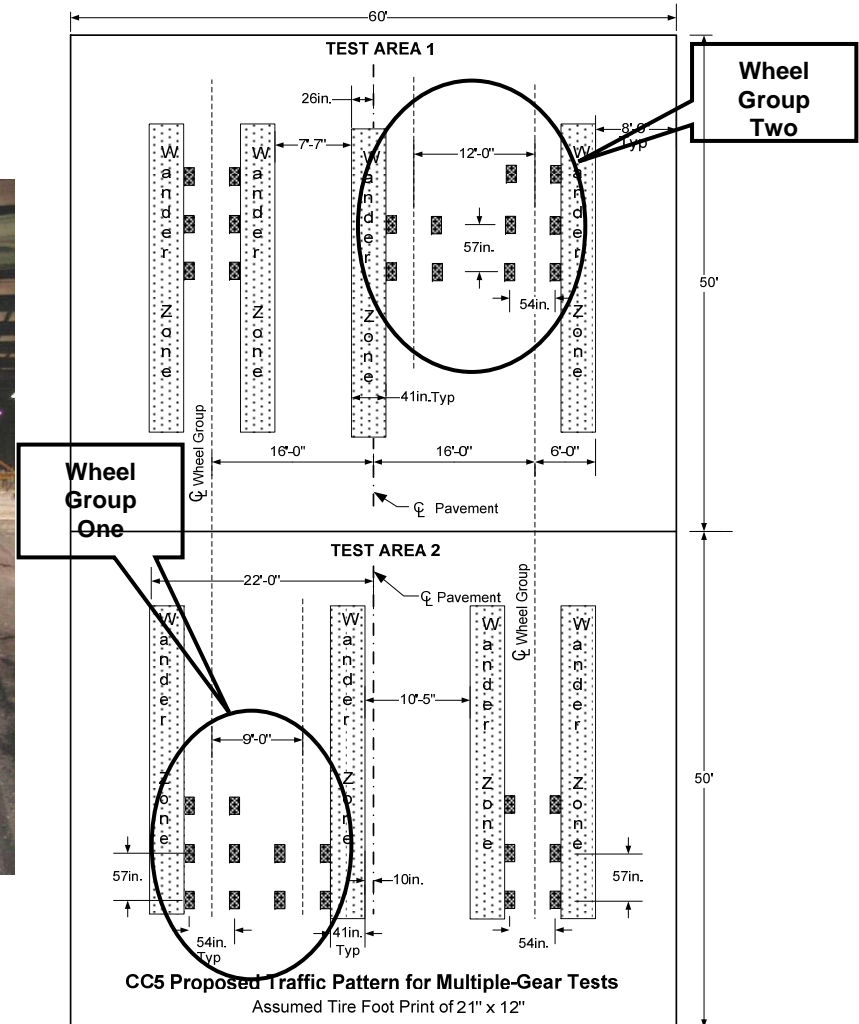
Full Scale Testing CC5 Test Plan & Profile



DuPONT CLAY SUBGRADE (TARGET CBR - 3.4)



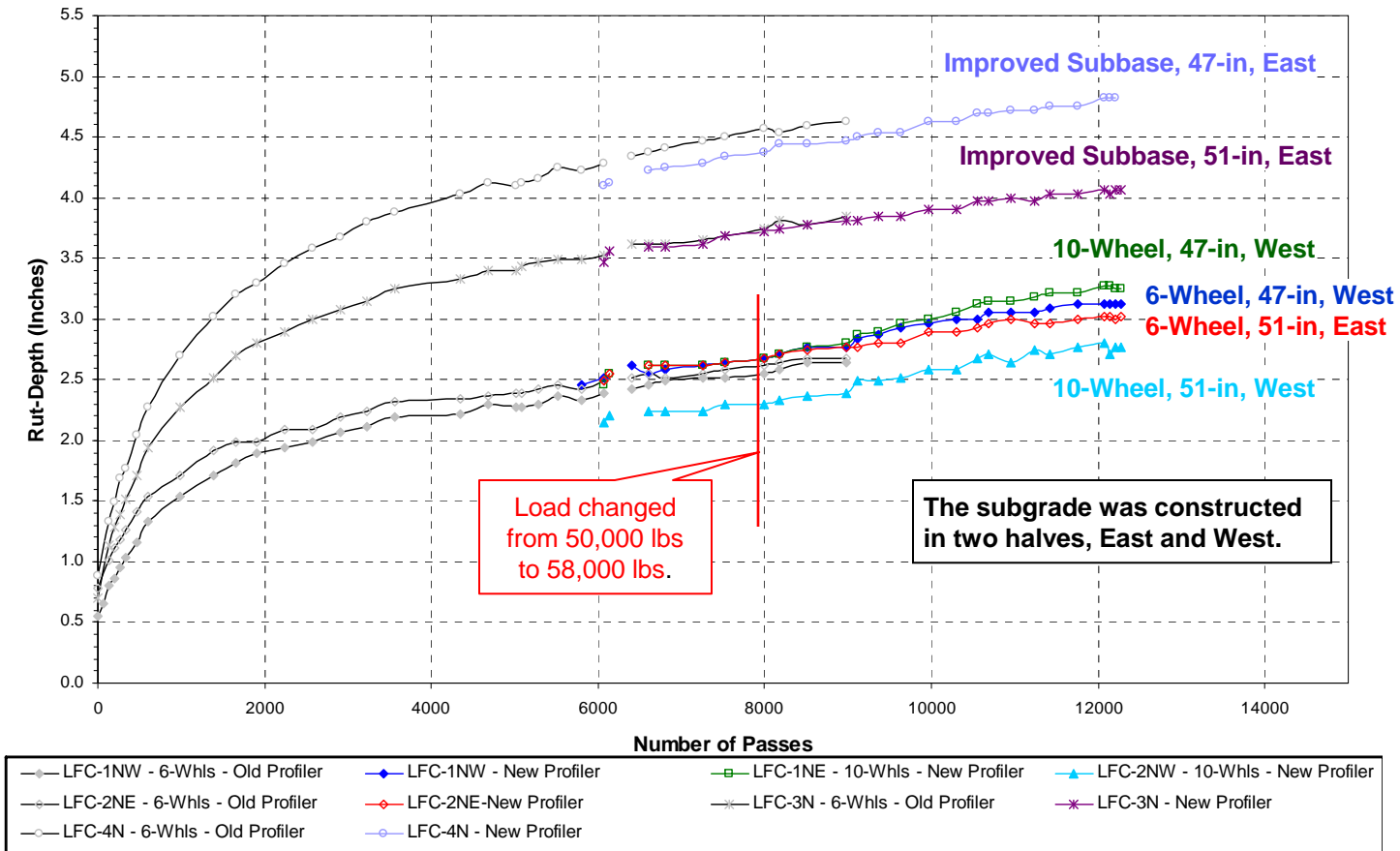
Full Scale Testing CC5 Gear Configuration



Full Scale Testing

CC5 Rut Depth Measurements

CC5- Rut Depth Measurements



Full Scale Testing

Construction Cycle 6 (CC6) – Rigid Pavement

- **Objectives**

- Primary

- The effect of concrete modulus of elasticity (E) on rigid pavement structural life

- Secondary

- Perform side-by-side comparison of Cement and Asphalt stabilized bases.
- Perform side-by-side comparison of thickened edge isolation joint and reinforced isolation joint.
- Develop a standard procedure for using PSPA on rigid pavement.
- Study the required compaction requirements under rigid pavements.



Full Scale Testing CC6 Layout and Details



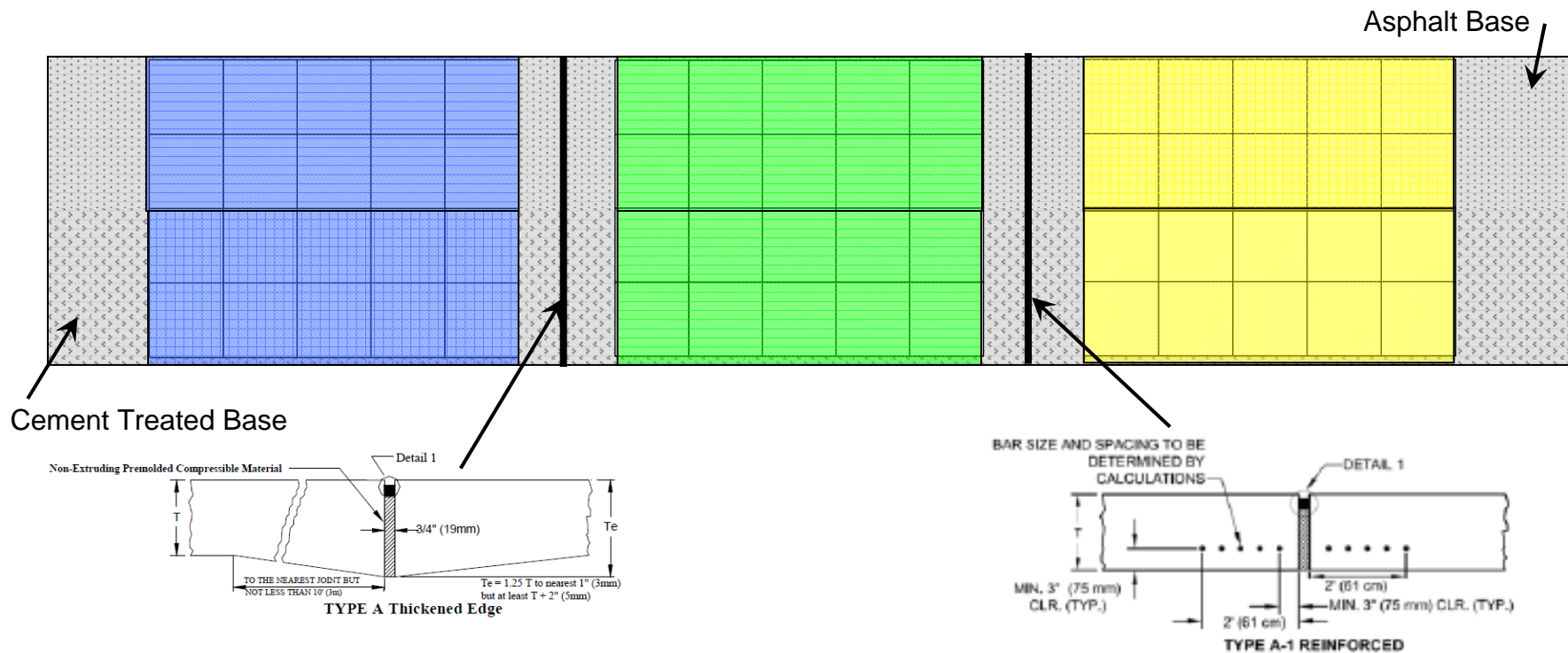
- High Modulus Concrete



- Med. Modulus Concrete

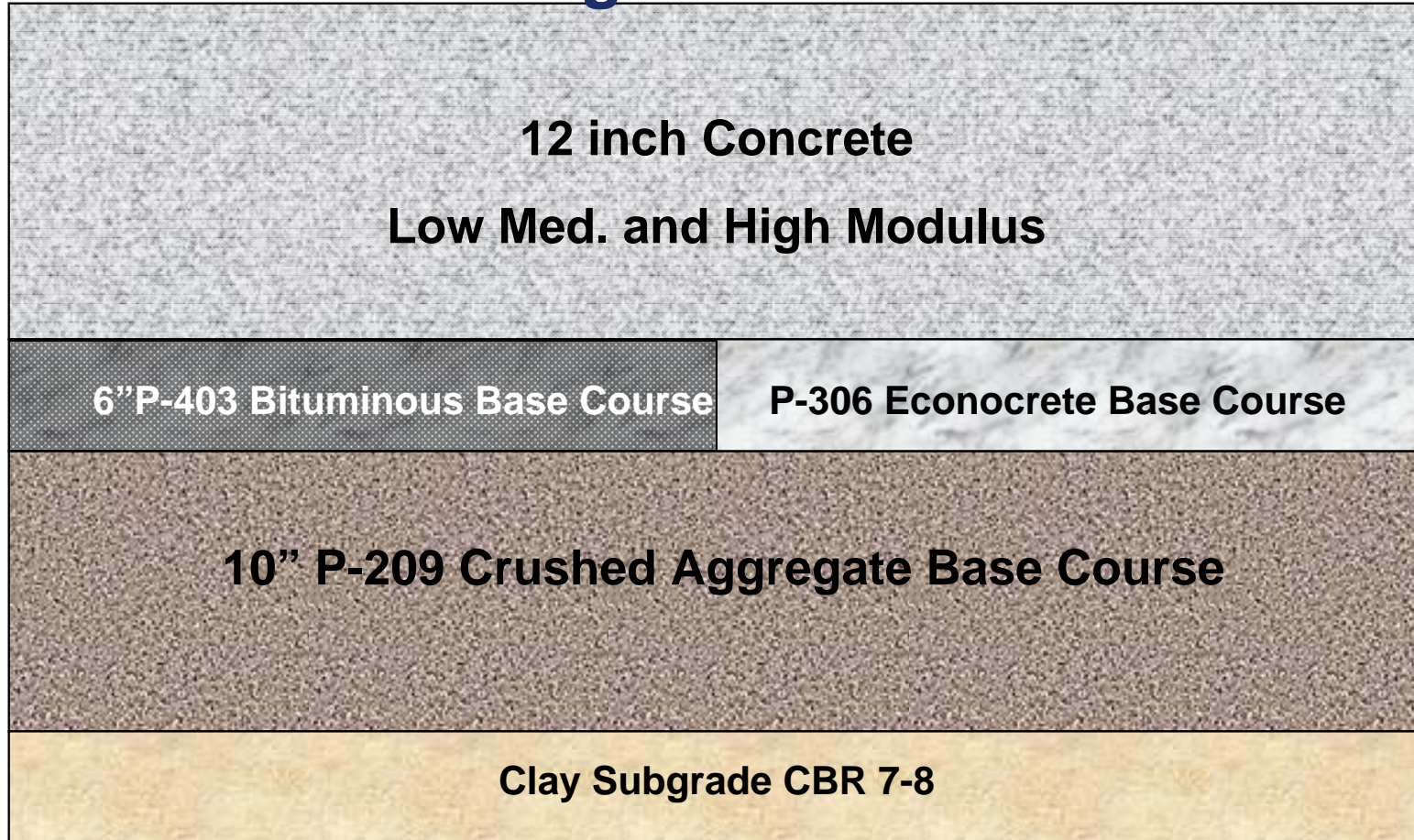


- Low Modulus Concrete



Full Scale Testing

CC6 Pavement Design



Full Scale Testing Construction Cycle 6



Started on June 24, 2009

Full Scale Testing

High Tire Pressure Tests

- **Issues**

- As airplane weights have increased, so have wheel loads and tire pressures.
- ICAO tire pressure limits under the ACN-PCN system are fixed.
- Tire pressures are now crossing the ICAO limit and in the future some aircraft may not be allowed to operate at full load on some pavements.
- A340-500/-600, 747-400ER, A380-800F, 777-300ER and new 787, A350 and 747-8 all exceed category X upper limit.



Full Scale Testing

High Tire Pressure Tests

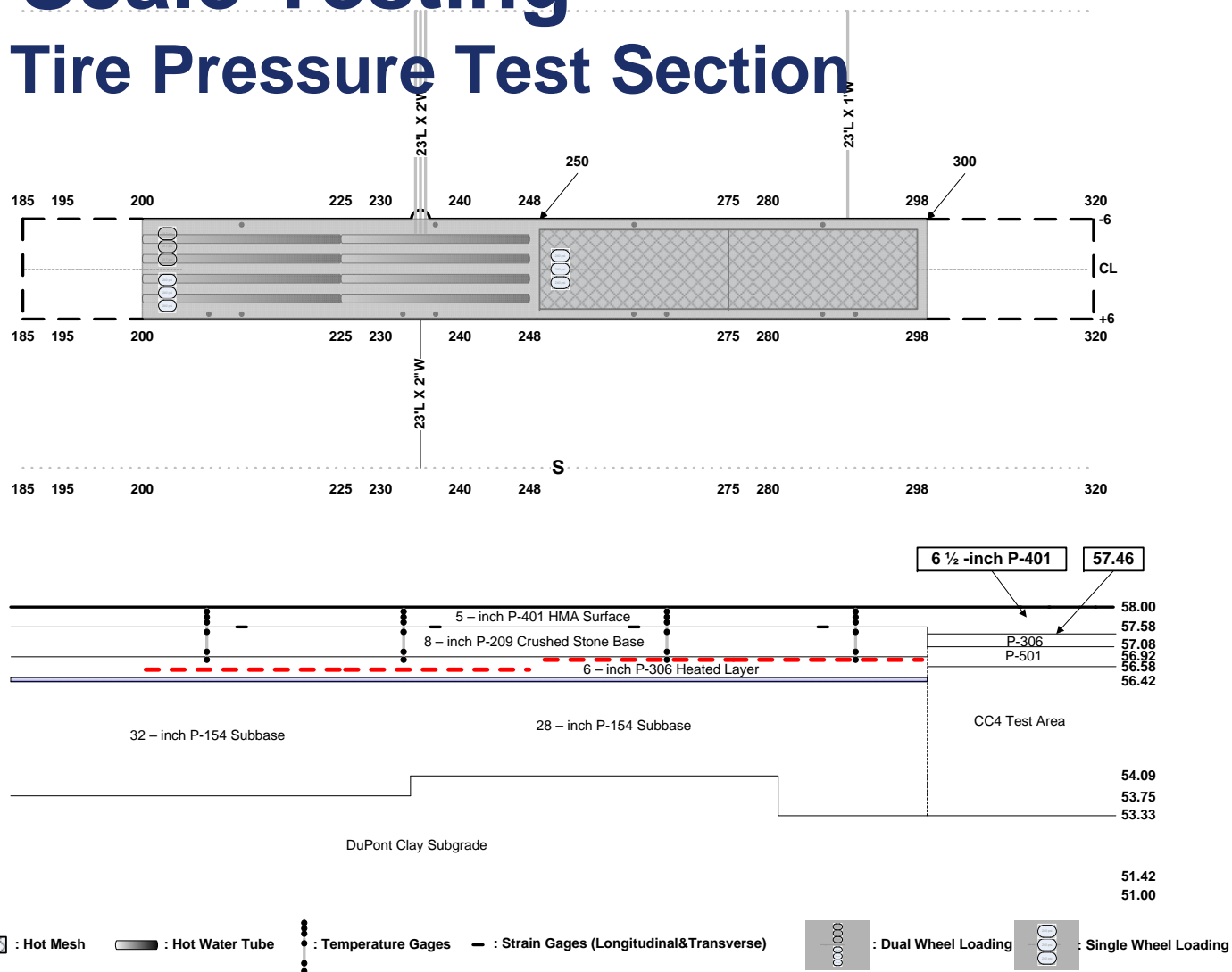
- **Objectives**

- To control and increase pavement temperatures of a HMA layer
- Compare rutting @ tire pressures of 218 and 240 psi with single wheel loads of 60-65 K
- Propose Changes to ICAO Tire Pressure Categories

Tire Pressure Category	Current ICAO Limits Psi (MPa)	Proposed New ICAO Limits Psi (MPa)
W	Unlimited	Unlimited
X	217 (1.50)	240 (1.65)
Y	145 (1.0)	181 (1.25)
Z	72 (.50)	72 (.50)

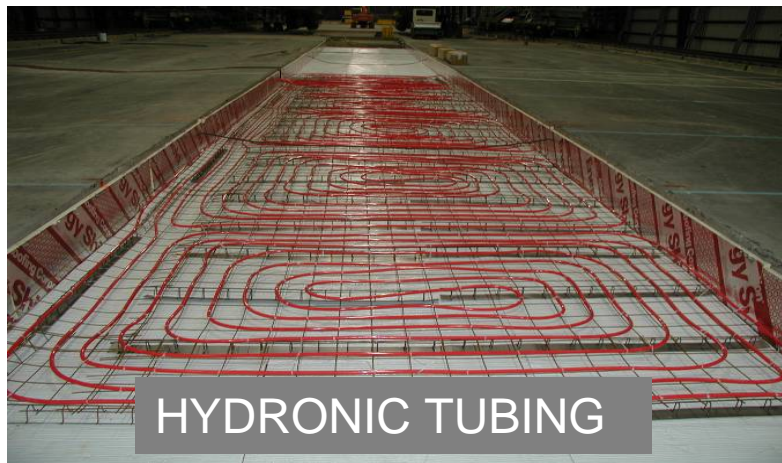
Full Scale Testing

High Tire Pressure Test Section



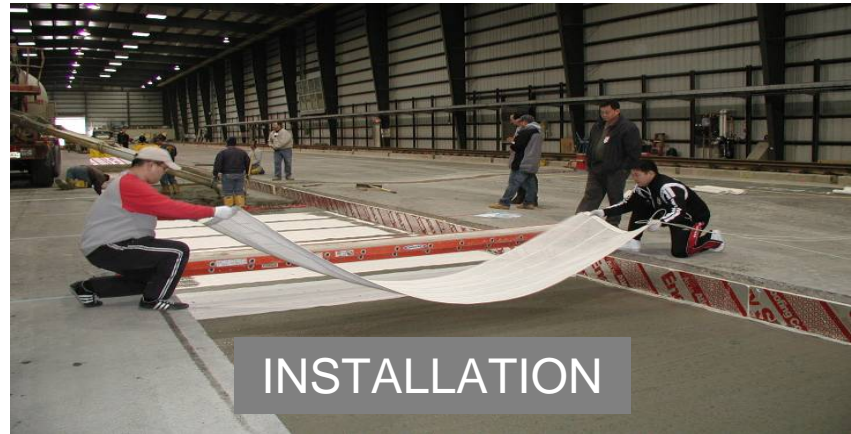
Full Scale Testing

High Tire Pressure Tests



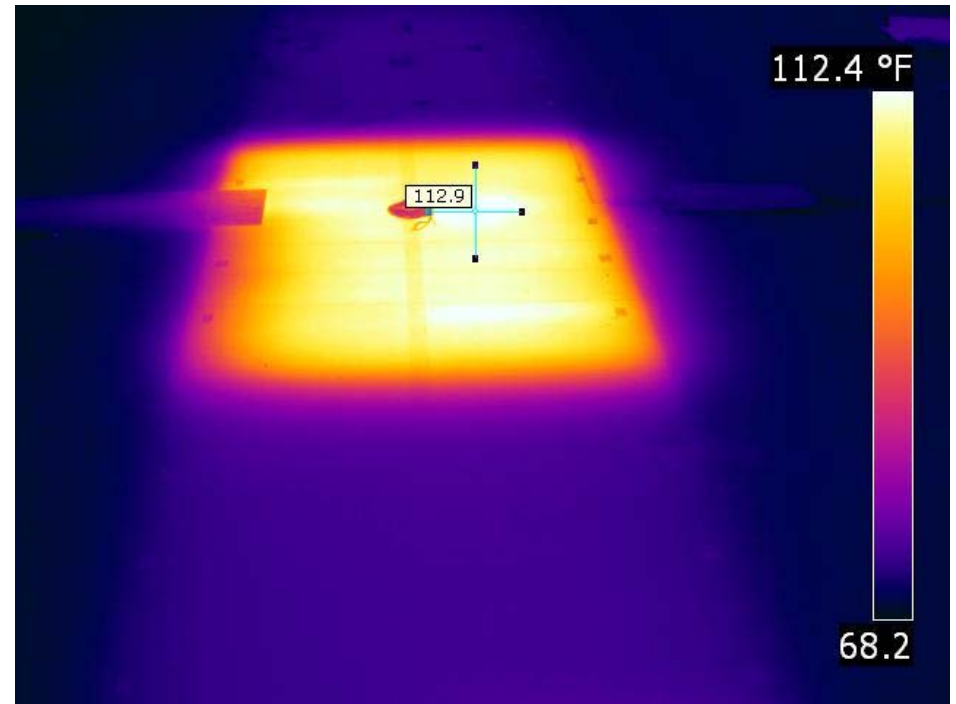
Full Scale Testing

High Tire Pressure Tests



Full Scale Testing

High Tire Pressure Tests



PAVEMENT
TEMPERATURE

Full Scale Testing

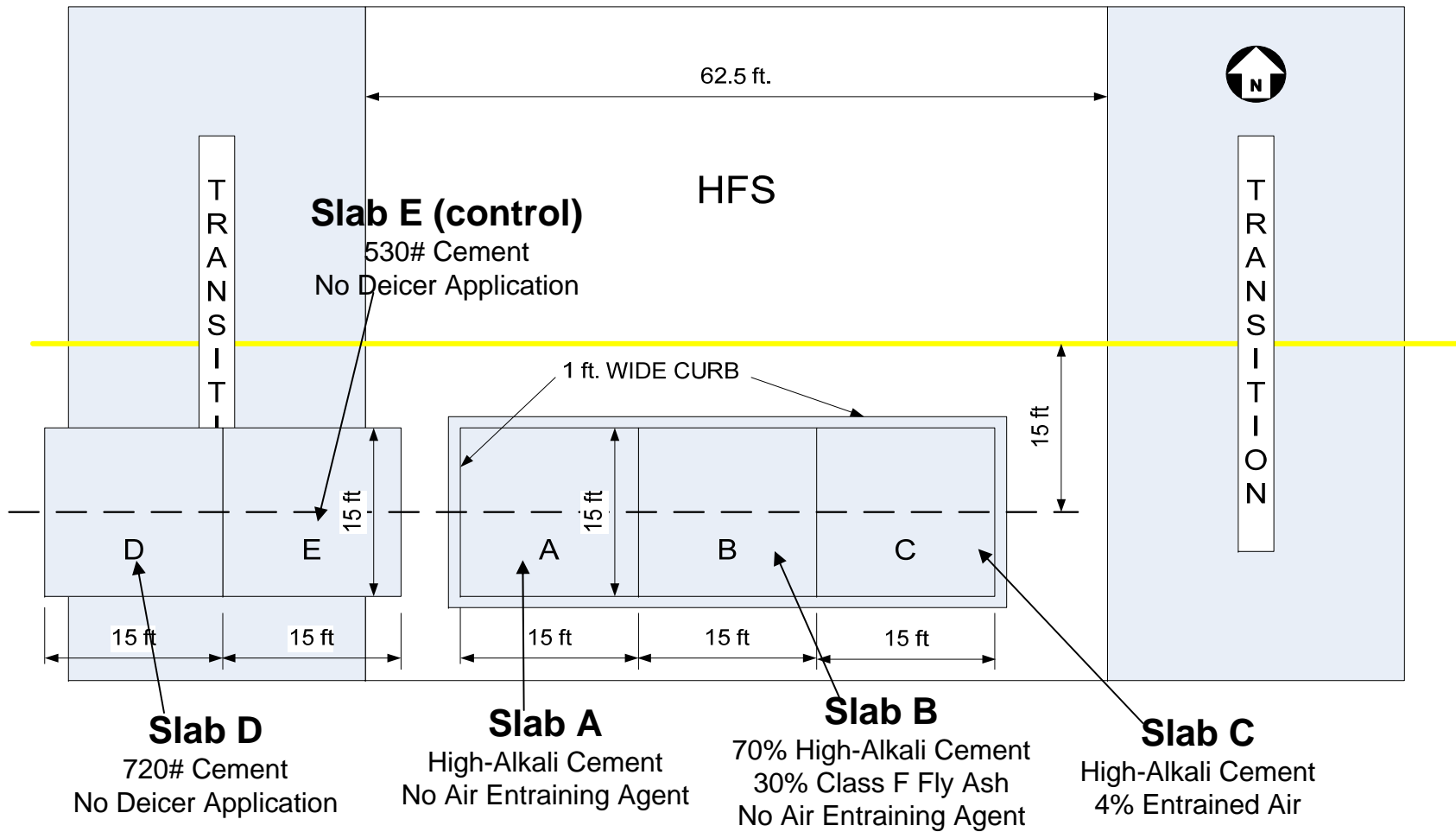
Alkali-Silica Reactive (ASR) Slabs

- **Objectives**

- Study the feasibility of conducting large scale accelerated Alkali Silica Reactivity in concrete slabs.
 - Develop methods to accelerate the ASR reaction.
- Investigate the effects of ASR on the structural capacity of concrete slabs.
 - Develop plans to apply loads to the ASR affected slabs.
 - Monitor deterioration of slabs both with and without loading.

Full Scale Testing

Alkali-Silica Reactive (ASR) Slabs



Full Scale Testing

Alkali-Silica Reactive (ASR) Slabs

Data	Interior Slabs			Exterior Slabs		
	A	B	C	A	B	C
Size	15 × 15 ft.					
Thickness	12 in.					
Concrete Mix	Reactive Aggregates; High-Alkali Cement (min. 0.82% Na ₂ O _{eq}); 0.55 w/c					
Air Entrainment*	No admixture 1.2%	No admixture 0.9%	4% 5.4%	No admixture 1.2%	No admixture 1.0%	4% 5.2%
Fly Ash*	0	30% Cl. F	0	0	30% Cl. F	0
Deicer	Potassium Acetate					

*Both air entrainment and fly ash replacement will reduce susceptibility to ASR in concrete mixtures.

As-Built Test Results



Full Scale Testing

Alkali-Silica Reactive (ASR) Slabs

Exterior



Interior



Full Scale Testing

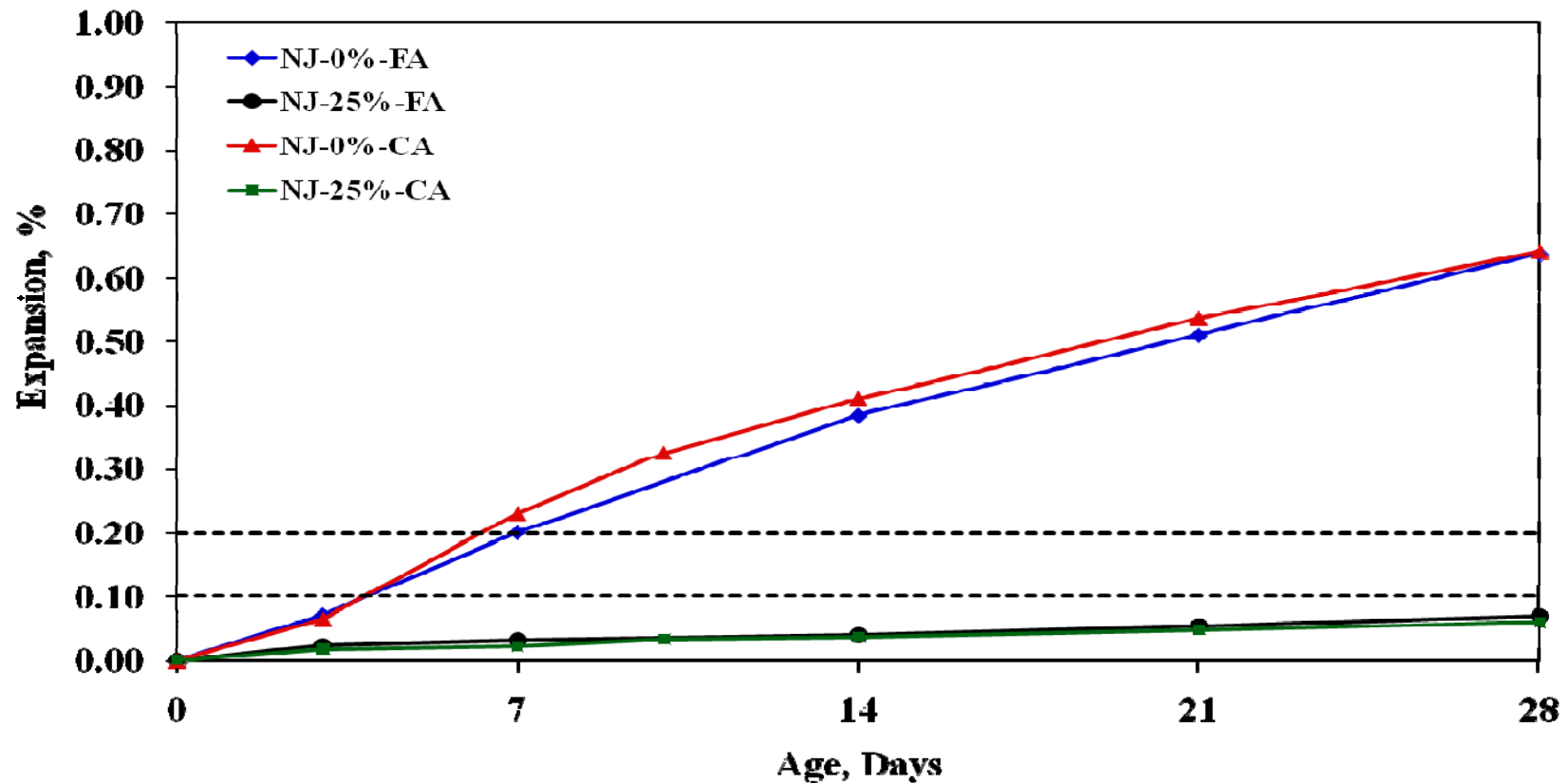
Alkali-Silica Reactive (ASR) Slabs

- **Macro Changes**
 - Physical Expansion (install survey pins to measure gross length change).
 - Modulus of Elasticity (PSPA, GPR, HWD, etc.).
 - Joint gage monitoring.
- **Micro Structural Changes**
 - Presence and location of ASR cracks.
 - Presence and location of ASR gel.
 - Alteration of paste chemistry.
- **Petrography**
 - Cores at 12, 18 and 24 months will be sent to Clemson University for evaluation.



Full Scale Testing Alkali-Silica Reactive (ASR) Slabs

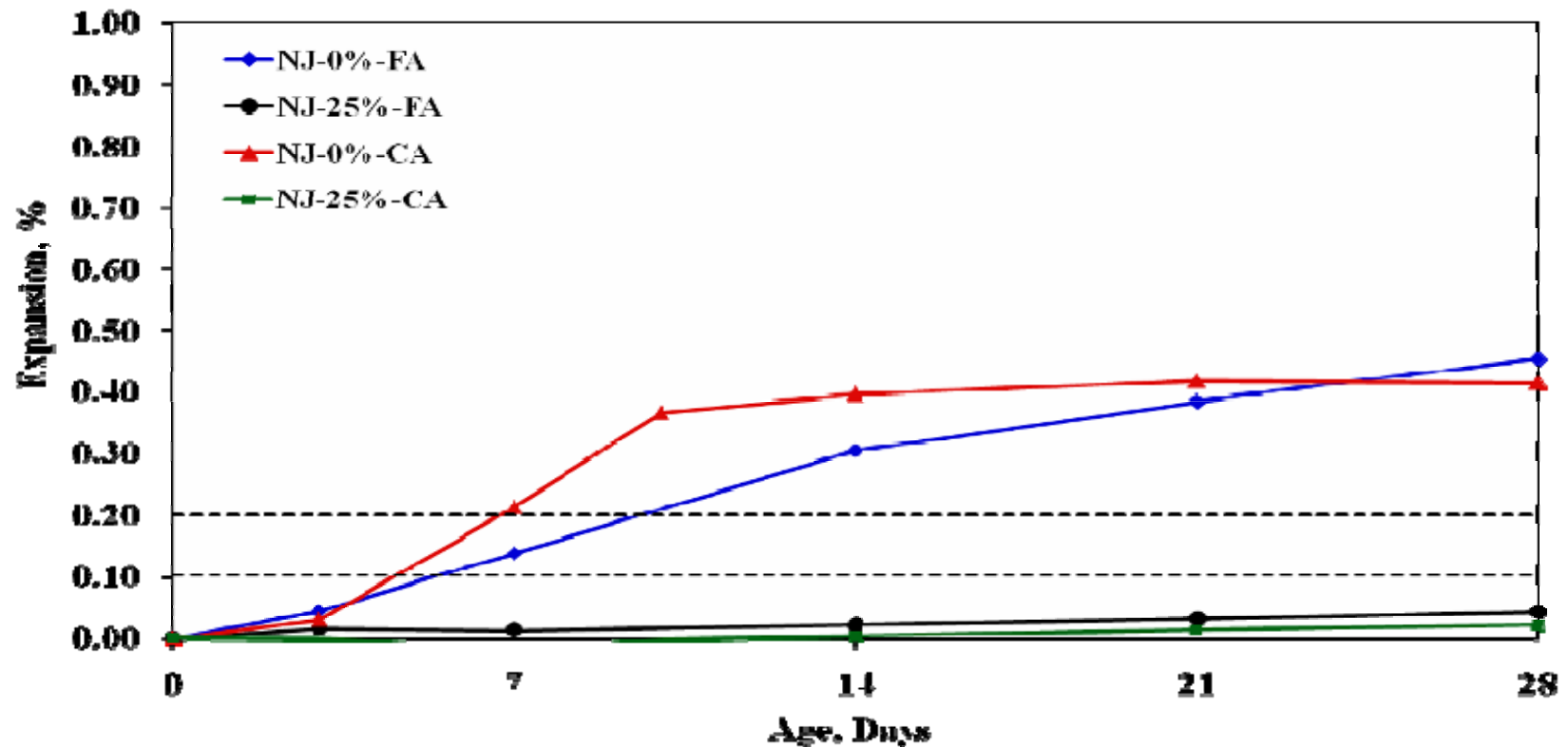
Standard ASTM 1260 & 1567 Results for NJ Aggregate



Full Scale Testing

Alkali-Silica Reactive (ASR) Slabs

Modified ASTM 1260 & 1567 Results for NJ Aggregate (K_{Ae})



Software

FAARFIELD

F Federal
A Aviation
A Admistration
R Rigid and
F Flexible
L Literative
E Elastic
L Layered
D Design

- Computer program for desktop PCs.
- Program preserves the “look and feel” of LEDFAA 1.3.
- Major changes are internal.
- Incorporates advanced structural models:
 - 3-D finite element analysis for rigid pavements and overlays.
 - NIKE3D (3D finite element analysis)
 - INGRID (3D mesh generation)
 - Layered elastic analysis (LEAF) for flexible pavements and overlays.

Software

FAARFIELD

- **Key Differences from LEDFAA 1.3**
 - Rigid Pavements/Overlays
 - Slab edge stresses are now computed directly using 3D-FEM.
 - Completely revised rigid pavement failure model.
 - Rewrote and improved rigid overlay design procedures.
 - Supports PCC overlay design on rubblized base.
 - Flexible Pavements/Overlays
 - Automatic base thickness design.
 - Supports HMA overlay design on rubblized base.



Software

FAARFIELD

- **Key Differences from LEDFAA 1.3**
 - General
 - Upgrade to MS Visual Basic.NET programming environment.
 - Aircraft library updated.
 - New function allows user to export design data to XML.
 - All user options collected on one “Options” screen.
 - External aircraft library in XML format.
 - Displays CDF values graphically.
 - Enhanced Airplane Data window now displays gear coordinates.
 - Design is now computed for constant tire contact area.



Software

COMFAA 3.0

COMFAA

Computation of ACN/PCN Federal Aviation Administration

- The new PCN methodology will use the CDF concept
- Incorporated in a new advisory circular AC 150/5335-5B “Standardized Method of Reporting Airport Pavement Strength – PCN,” replacing AC 150/5335-5A.

Software COMFAA 3.0

COMFAA 3.0, May 11 2009 - C:\COMFAA 3.0 Beta 7-7-09\COMFAAaircraftPCN.Ext

X = -19.1 in Y = -41.4 in

Aircraft Group

- Generic
- Airbus
- Boeing
- McDonnell Douglas
- Other Commercial
- Military
- External Library

Library Aircraft

- A300 B4 std
- A318-100 std
- A319-100 std
- A320-100
- A330-200 std
- A340-200 std
- A380 2D
- B717-200
- B727-200 basic
- B737-700
- B747-400
- B757-300
- B767-300 ER
- B777-200 Baseline
- B787-8 pre
- DC10-10
- DC-8
- DC-9-30
- MD-11
- MD-83
- MD-90

Critical Aircraft

ACN

Subgrade Category

Gross Weight (lbs)	365,750
% GW on Main Gears	94.00
No. Main Gears	2
Wheels on Main Gear	4
Tire Pressure (psi)	216.1
Input Alpha	0.000
Alpha Used	0.000
Coverages (20 yr total)	4,579
Flex Ann Dep P/C = 1.82	417
Rig Ann Dep P/C = 3.65	836
Rigid Cutoff (times rrs)	3.00
ConcreteFlexuralStrength	700.0

Computational Mode

PCN Flexible Batch PCN Rigid Batch MORE >>>

SG	CBR	CBR t, in	ACN Flex	k, lbs/in ³	Rig t, in	ACN Rig
D						
C						
B						
A	0.00			323.0		

Evaluation Thickness = 18.00 Stress =

1. Select External Library

3. Select for automated PCN calculation

2. Input k and Design Thickness

2. Input Concrete Strength



Software COMFAA 3.0

The screenshot shows the COMFAA 3.0 software window. On the left, there are two tree views: 'Aircraft Group' and 'Library Aircraft'. The 'Library Aircraft' list includes various Boeing models like B707-320C, B720B, B717-200 HGW, B727-100C Alternate, Adv. B727-200 Basic, Adv. B727-200 Option, B737-100, Adv. B737-200, Adv. B737-200 LP, B737-300, B737-400, B737-500, B737-600, B737-700, B737-800, and B737-900 ER. A blue arrow points from the 'Add' button in the control panel to the 'B737-900 ER' entry in the library list.

Design Aircraft (21)	Gross Weight (lbs)	Coverages (20 yr total)	Flex Ann Dep P/C	Rig Ann Dep P/C	% GW on Main Gear	No. Main Gears
A300 B4 std	365,750	4,579	414	831	95.00	2
A318-100 std	124,500	3,593	654	654	95.00	2
A319-100 std	142,500	70,663	12,967	12,967	95.00	2
A320-100	151,000	79,583	15,280	15,280	95.00	2
A330-200 std	509,000	936	88	176	95.00	2
A340-200 std	608,000	1,884	179	358	78.00	2
A380 2D	1,235,000	309	30	59	38.00	2
B717-200	122,000	1,701	301	301	95.00	2
B727-200 basic	185,200	760	111	111	95.00	2
B737-700	180,000	90,000	10,000	10,000	95.00	2

At the bottom, there is a control panel with buttons: 'Add', 'Remove', 'Save List', 'Clear List', 'Save Ext File', 'Load Ext File', 'Save to Float', 'Add Float', 'Back', 'Cancel', 'Help', and a 'Float Aircraft' section.

Traffic mix can be created by adding or removing airplanes from existing Aircraft Group library or by loading an Ext text file

Software

COMFAA 3.0 – Additional Analysis

The screenshot shows the COMFAA 3.0 software interface. The main window displays a graph with three circles representing aircraft subgrade categories (D, C, A) on the x-axis and ACN (Aircraft Classification Number) on the y-axis. The graph shows a large black circle for category D, a smaller black and white circle for category C, and another large black circle for category A. The y-axis ranges from 10 to 100. The x-axis is labeled 'Subgrade Category' with points D, C, B, and A. The software title bar indicates 'COMFAA 3.0, May 11 2009 - C:\COMFAA 3.0 Beta 7-7-09\COMFAAaircraftPCN.Ext'. The interface includes a left sidebar with 'Aircraft Group' and 'Library Aircraft' lists, a central graph area, and a right sidebar with 'Edit Wheels' and 'Miscellaneous Functions' buttons. A 'Options' section at the bottom right has checkboxes for 'Batch', 'PCA Thick', 'Metric', and 'PCA GW', and a radio button for '*07 Alphas'. A 'Computational Mode' section has radio buttons for 'ACN', 'Thickness', 'Stress', and 'Edge Stress', and buttons for 'Flexible' and 'Rigid'. A 'LESS <<<' button is highlighted with a blue arrow. Below the graph is a table of aircraft specifications and a table of subgrade data.

SG	CBR	CBR t, in	ACN Flex	k, lbs/in ³	Rig t, in	ACN Rig
D						
C						
B						
A	0.00			323.0		

Gross Weight (lbs)	155,000
% GW on Main Gears	91.70
No. Main Gears	2
Wheels on Main Gear	2
Tire Pressure (psi)	205.0
Input Alpha	0.000
Alpha Used	0.000
Coverages (20 yr total)	10,000
Flex Ann Dep P/C = 3.81	1,905
Rig Ann Dep P/C = 3.81	1,905
Rigid Cutoff (times rrs)	3.00
Concrete Flexural Strength	700.0

Evaluation Thickness = 18.00 Stress = 385.57

Select More/Less to bring up additional options

Additional options allow edge stress and PCA center case stress calculations.

ACN mode of existing COMFAA program still available

Software

COMFAA 3.0 – Results Page

Results Rigid 7-9-2009.txt - Notepad

This file name = Results Rigid 7-9-2009.txt
Library file name = C:\COMFAA 3.0 Beta 7-7-09\COMFAAaircraftPCN.Ext

Evaluation pavement type is rigid
Equivalence coverages computed with the AC 150/5320-6C/D method.
Maximum gross weight computed with the AC 150/5320-6C/D method.

k Value = 323.0 lbs/in³
flexural strength = 700.0 psi
Evaluation pavement thickness = 18.00 in

Aircraft Name	Gross Weight	Percent Gross Wt	Tire Press	Annual Deps	20-yr Coverages	6D Thick
A300 B4 std	365,750	94.00	216.1	836	4,579	11.64
A318-100 std	124,500	90.40	147.9	670	3,593	9.67
A319-100 std	142,500	92.60	172.6	13,143	70,663	12.90
A320-100	151,000	94.00	200.1	15,360	79,583	13.82
A330-200 std	509,000	94.80	205.9	88	936	11.71
A340-200 std	608,000	79.58	206.0	177	1,884	11.99
A380 2D	1,235,000	38.05	218.0	59	309	11.50
B717-200	122,000	94.42	164.0	302	1,701	10.33
B727-200 basic	185,200	96.00	148.0	111	760	11.84
B737-700	188,200	91.70	205.0	16,731	96,709	15.76
B747-400	877,000	93.32	200.0	761	4,358	12.06
B757-300	271,000	92.62	195.0	10,208	51,555	11.69
B767-300 ER	413,000	92.40	200.0	2,556	14,006	12.50
B777-200 Baseline	537,000	95.42	185.0	1,092	5,153	9.63
B787-8 pre	478,000	93.80	220.0	32	169	11.45
DC10-10	458,000	93.32	195.0	119	622	10.90
DC-8	358,000	96.12	196.0	79	472	11.19
DC-9-30	109,000	92.40	155.0	8	44	8.49
MD-11	633,000	77.54	206.0	44	240	11.58
MD-83	161,000	94.76	195.0	739	4,322	12.54
MD-90	168,500	93.96	193.0	214	1,283	12.29

Aircraft Name	Critical Aircraft Total Equiv. Covs.	Max. Allowable Gross Weight	PCN at Indicated Strength			
			A(552)	B(295)	C(147)	D(74)
A300 B4 std	1,365,963	434,944.4	62.1	73.5	85.1	95.2
A318-100 std	>10,000,000	148,189.5	33.6	36.3	38.8	40.9
A319-100 std	6,366,010	174,640.1	44.4	47.4	50.1	52.3
A320-100	1,474,734	186,268.9	51.2	54.1	56.7	58.9
A330-200 std	400,263	639,943.1	70.8	83.4	99.7	115.8
A340-200 std	388,029	764,511.7	71.0	83.7	100.1	116.3
A380 2D	267,332	1,514,318.0	73.7	87.5	103.8	119.0
B717-200	>10,000,000	147,214.7	43.6	45.8	47.7	49.2
B727-200 basic	274,674	233,290.4	65.5	69.7	73.4	76.3

PCN Results- B subgrade



Software

FAA 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.
- An Internet (Web) based system was deemed to be the best option considering the mature status of web-based applications.
- The FAA also has a need for system-wide dissemination and analysis of the performance of FAA sponsored pavement projects.
- 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.



Software

FAA PAVEAIR

- **Program Requirements**

- Web-based application that provides a system for easy dissemination of information for airport pavement construction, maintenance, and management.
- Data for multiple airports available on a single server connected to the web
- Make the complete application available for free download:
 - As a set of installation files.
 - Full source code.
 - Documentation for installation and operation.
- Suitable for installation and use on:
 - Single PC
 - Private network
 - Intranet or Internet.



Software

FAA PAVEAIR

- **Current Status– Subject to Testing and Reviews**
 - The development phase of alpha version should be complete by September 2009
 - Testing is anticipated to continue for approximately one year
 - The release of a beta version should take place prior to September 2010
 - The first release of FAA PAVEAIR will have the same functionality of MicroPAVER version 5.3.
 - *Tentative first deployment – September 2010.*



Software

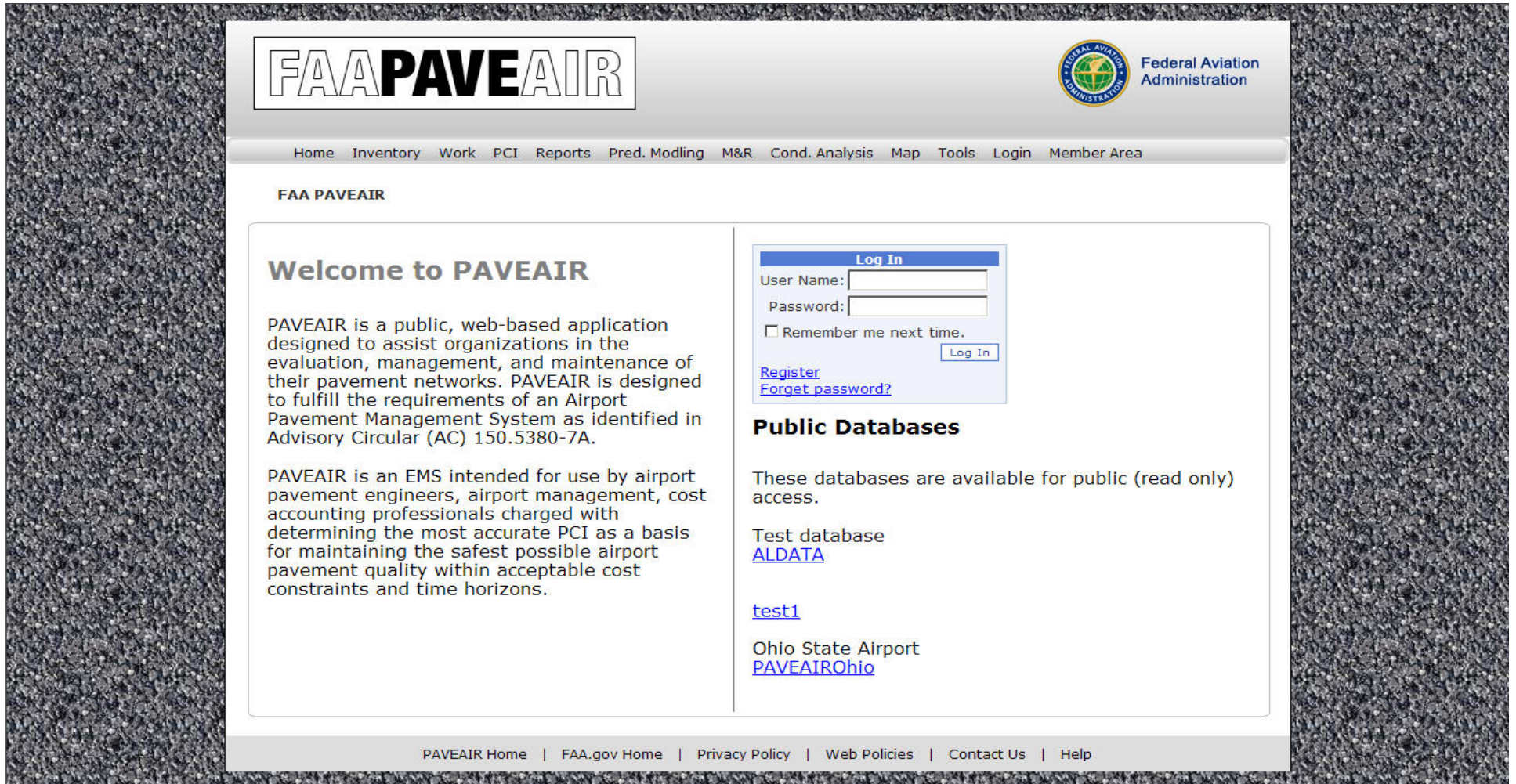
FAA PAVEAIR

- **Possible Implementations**
 - By the FAA for AIP projects.
 - 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.
- **Will continue support and development after initial deployment; for example include functions to comply with existing FAA GIS Standards.**



Software

FAA PAVEAIR – Home Page



The screenshot shows the FAA PAVEAIR Home Page. At the top left is the 'FAA PAVEAIR' logo. At the top right is the Federal Aviation Administration logo. Below these is a navigation menu with links: Home, Inventory, Work, PCI, Reports, Pred. Modling, M&R, Cond. Analysis, Map, Tools, Login, Member Area. The main content area is titled 'FAA PAVEAIR' and contains a 'Welcome to PAVEAIR' section. This section includes two paragraphs: the first describes PAVEAIR as a public, web-based application for pavement network evaluation and management; the second describes it as an EMS for airport pavement engineers and management. To the right of the welcome text is a 'Log In' form with fields for 'User Name' and 'Password', a 'Remember me next time.' checkbox, and a 'Log In' button. Below the form are links for 'Register' and 'Forget password?'. Further down is a 'Public Databases' section with the text 'These databases are available for public (read only) access.' and links for 'Test database ALDATA', 'test1', and 'Ohio State Airport PAVEIROhio'. At the bottom of the page is a footer with links: PAVEAIR Home, FAA.gov Home, Privacy Policy, Web Policies, Contact Us, Help.

FAA PAVEAIR

Federal Aviation Administration

Home Inventory Work PCI Reports Pred. Modling M&R Cond. Analysis Map Tools Login Member Area

FAA PAVEAIR

Welcome to PAVEAIR

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.

PAVEAIR is an EMS 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.

Log In

User Name:

Password:

Remember me next time.

[Register](#)
[Forget password?](#)

Public Databases

These databases are available for public (read only) access.

Test database
[ALDATA](#)

[test1](#)


Ohio State Airport
[PAVEIROhio](#)

PAVEAIR Home | FAA.gov Home | Privacy Policy | Web Policies | Contact Us | Help

Software

FAA PAVEAIR – Work Page

FAA PAVEAIR



Federal Aviation
Administration

PAVEAIR Home Profile Password Data Management Logout **qjia**

FAA PAVEAIR : Member Area : Work

Network	1	Pike County Commissioners	test
Branch	202	Apron	
Section	562	C	APRON B AIRPORT ROAD
Work History	848	9/13/2003	New Construction - AC

WorkTrackingID	848
SectionID	562
DateTime	9/13/2003 12:00:00 AM
Work	New Construction - AC
Type	NC-AC
Project	FAA AIR 21
Phase	
Quantity	0
Thickness	38.1000000001524
ThicknessUnit	mm
Cost	0
MaterialType	Asphalt Concrete
Material	ODOT 448
Comment	ODOT 448
WorkCompleted	True
MajorMR	True
BackCalculated	
WorkAreaUnit	m ²
WorkLinearUnit	m
WorkThicknessUnit	in
WorkQuantityUnit	m ²
QuantityUnit	SqFt

[Update](#) [Cancel](#)

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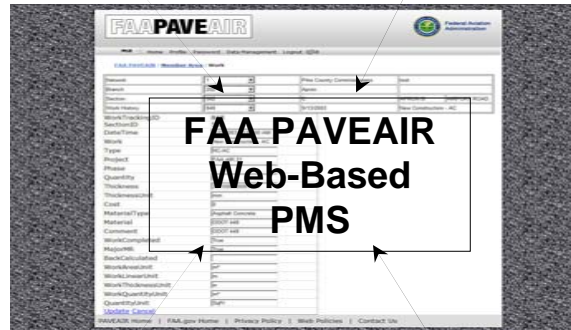
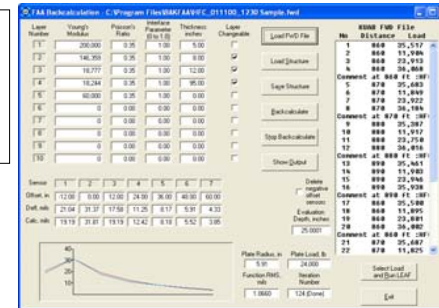
Software

FAA PAVEAIR – Integration



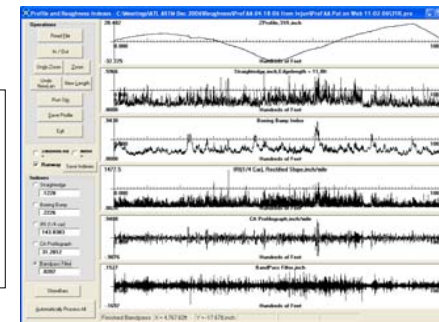
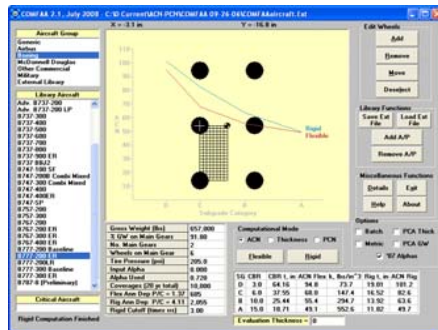
FAARFIELD
Thickness
Design

BAKFAA
Strength
Evaluation



COMFAA
PCN Load
Rating

ProFAA
Roughness
Condition
Evaluation



Research Projects

Gyratory Mix Design

- **Objectives**

- Establish N_{design} for P- 401, Plant Mix Bituminous Pavement.
- Revise P-401 Specifications using the Superpave Gyratory Compactor.
- Run verification testing on a variety of well performing HMA mixes.
- In parallel with and complimentary to an FAA sponsored study being performed by ERDC at WES.

Research Projects

Gyratory Mix Design

- **Phase 1:**
 - Determine N-design equivalent to 75-blow Marshall
- **Phase 2:**
 - Validate N-design with performance tests
 - Finalize N-design
- **Phase 3:**
 - Draft Superpave specification (New P-401)



Research Projects

Gyratory Mix Design

- Well performing Mixes

Mix Code	Aggregate Type	Nominal Maximum Aggregate Size	Binder Grade		
			PG 64-22	PG 76-22 SBS Modified	PG 76-22 PE-Modified
Mix-E1993	Gneiss	12.5 mm	X	X	X
Mix-E1996	Dolomite/granite	19 mm	X	X	X
Mix-E1997	Dolomite	25 mm	X	X	X
Mix-A	Basalt	19 mm	X		
Mix-D	Limestone	19 mm	X		
Mix-C	Crushed Gravel	19 mm	X	X	X
Mix-F	Argillite	12.5 mm	X		
Mix-B	Diabase	19 mm	X	X	X

Research Projects

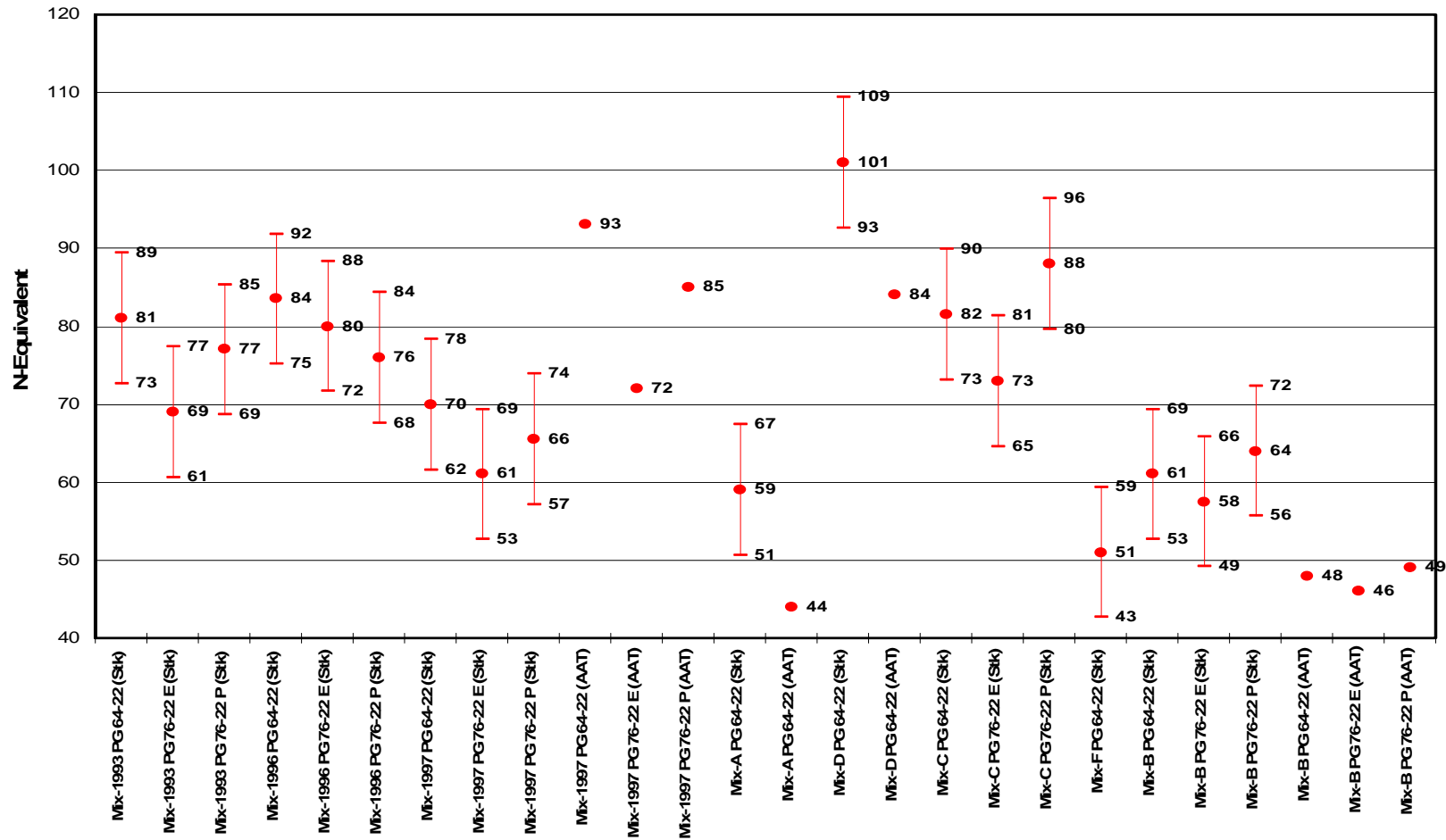
Gyratory Mix Design

N_{design} Summary

	FAA
Minimum	44
Maximum	104
Mean	72
Std. Dev.	15
COV, %	21.0

Research Projects

Gyratory Mix Design



Research Projects

Gyratory Mix Design

- **Phase 2: Performance Evaluation**
 - Evaluate effect of N_{des} on performance with respect to:
 - Asphalt content and/or gradation changes
 - Rut resistance: AMPT flow number & APA
 - Compatibility: compaction curve
 - Durability: film thickness & binder content



Research Projects

Gyratory Mix Design

Phase 2 Mix Designs

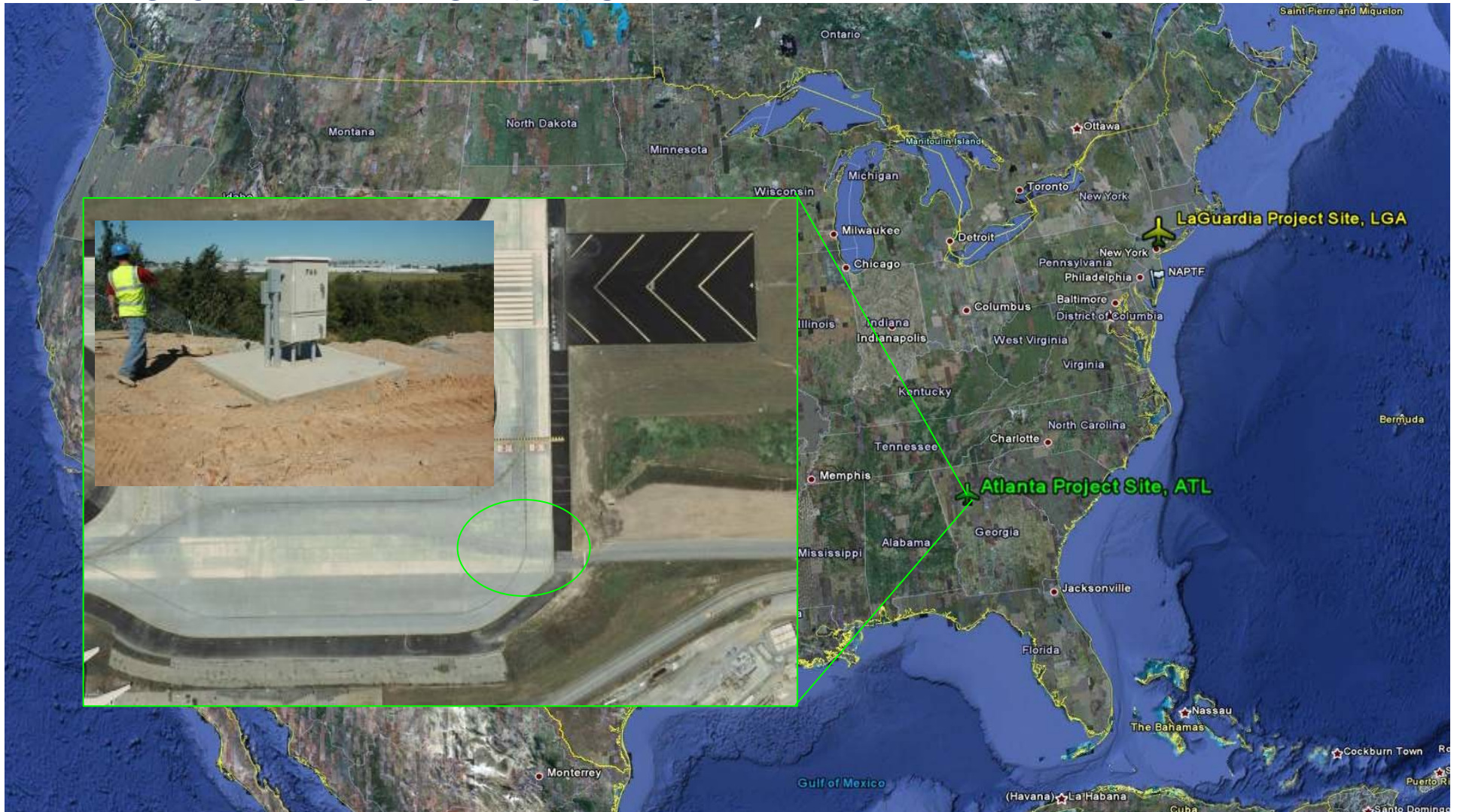
Mix Name	Aggregate	NMAS	Binder Grade
Airport E/1993	Gneiss	12.5 mm	AC 20
Airport E/1997	Dolomite	25 mm	PG 82-22 PG 64-22
Airport A	Basalt	19 mm	PG 64-22
Airport D	Limestone	19 mm	PG 70-22
Airport C	Crushed gravel	19 mm	PG 64-28
Airport F	Argillite	12.5 mm	PG 64-22
Airport B	Diabase	19 mm	PG 64-22
Oceana*	Granite	19 mm	PG 70-22

* New Mix – poor performer



Research Projects

Field Instrumentation - ATL



R&D Update – SWIFT 2009

September 16, 2009



Federal Aviation
Administration

Research Projects

Field Instrumentation - ATL

- **Why**
 - Current FAA design method does not consider slab curling or top-down cracking modes for rigid slabs.
- **Objectives**
 - Obtain in-situ data on vertical slab movements
 - Monitor slab data over an extended period.

Research Projects

Field Instrumentation - ATL

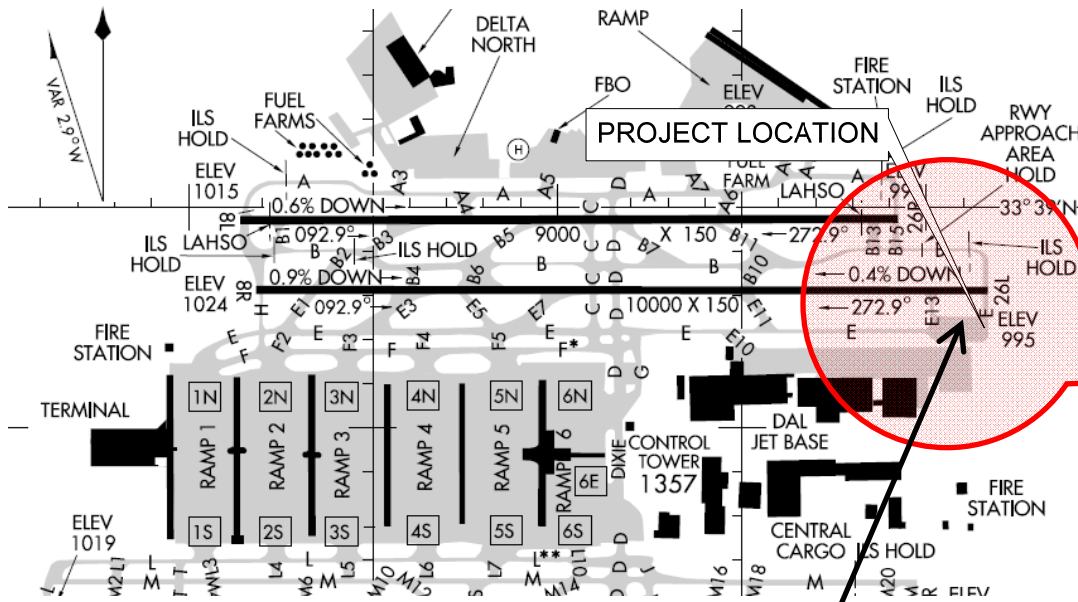
- **History**

- Oct 2006:
 - Construction Completed with 64 Sensors installed
 - Initial data collected using portable data system
- Mar 2007:
 - Permanent data collection and power generation system installed
- Aug 2007:
 - Lightning Strike to System
- Aug 2008:
 - Reinstalled Data Acquisition System & installed lightning suppression system
- Jan 2009:
 - Installed New Data Acquisition System



Research Projects

Field Instrumentation - ATL



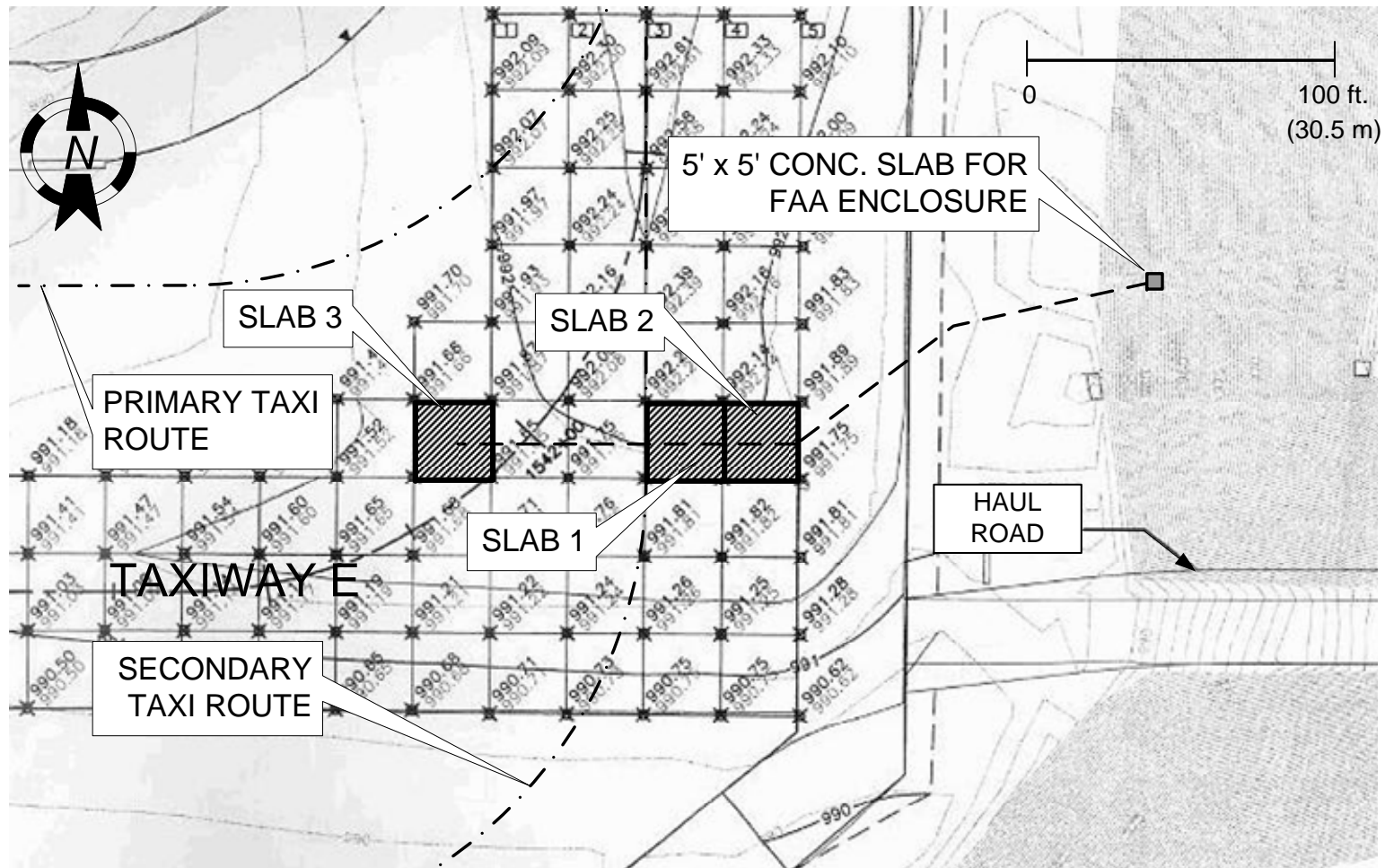
RUNWAY 26L

Project Location –
Taxiway E



Research Projects

Field Instrumentation - ATL



Research Projects

Field Instrumentation - ATL



Research Projects

Field Instrumentation - LGA



Research Projects

Field Instrumentation - LGA

- **Why**

- Very little research has been performed on asphalt longitudinal construction joints even though they are a known maintenance issue
- No one has instrumented the joints to evaluate the causes of cracking after construction

- **Objectives**

- To measure the strains and movement of these joints to better understand the failure/cracking mode
- Evaluate movement of joint due to environmental effects

Research Projects

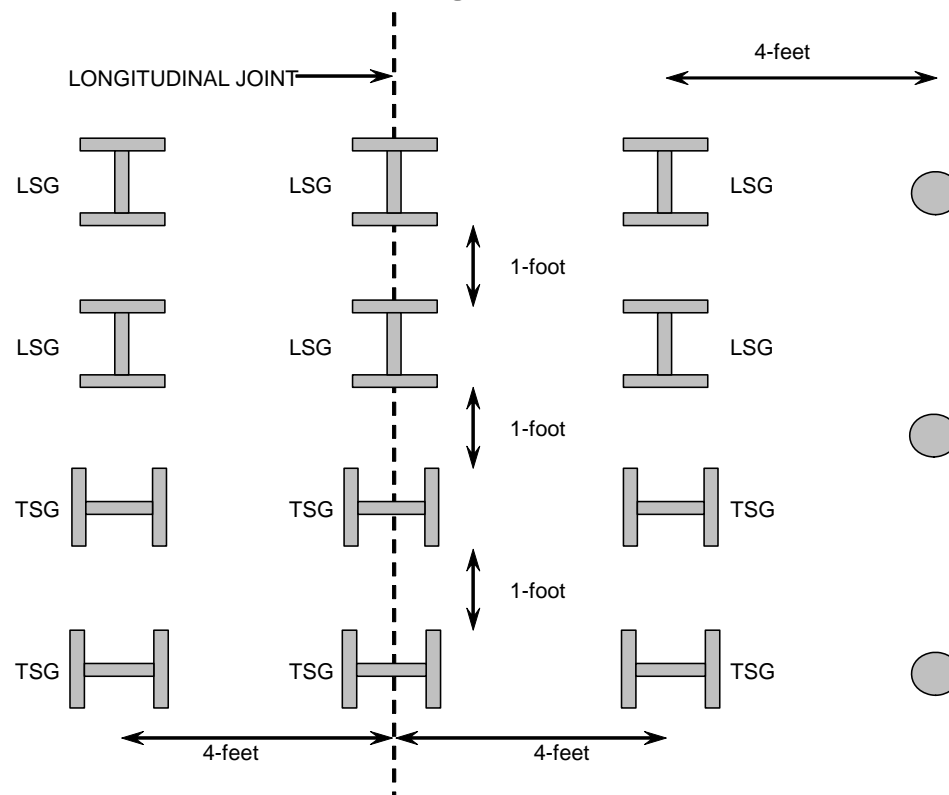
Field Instrumentation - LGA



Research Projects

Field Instrumentation - LGA

- **Instrumentation**
 - H Bar Asphalt Strain Gages



Research Projects

Field Instrumentation - LGA

- **Instrumentation Plan Submitted to Port Authority**
 - Port Authority awarded the bid. Bid included:
 - Installation of FAA data collection cabinet
 - Installation of all FAA underground conduit
 - All saw cutting and coring required for gage installation
- **Components**
 - Similar to ATL
 - Campbell Scientific Data Acquisition System
 - Have direct power / no solar panels
 - Remote Access / no phone line
- **Installed gauges on Aug. 17th**



Research Projects

Field Instrumentation - LGA



Research Projects

Field Instrumentation - DIA



R&D Update – SWIFT 2009

September 16, 2009



Federal Aviation
Administration

Research Projects

Field Instrumentation - DIA

- **History**

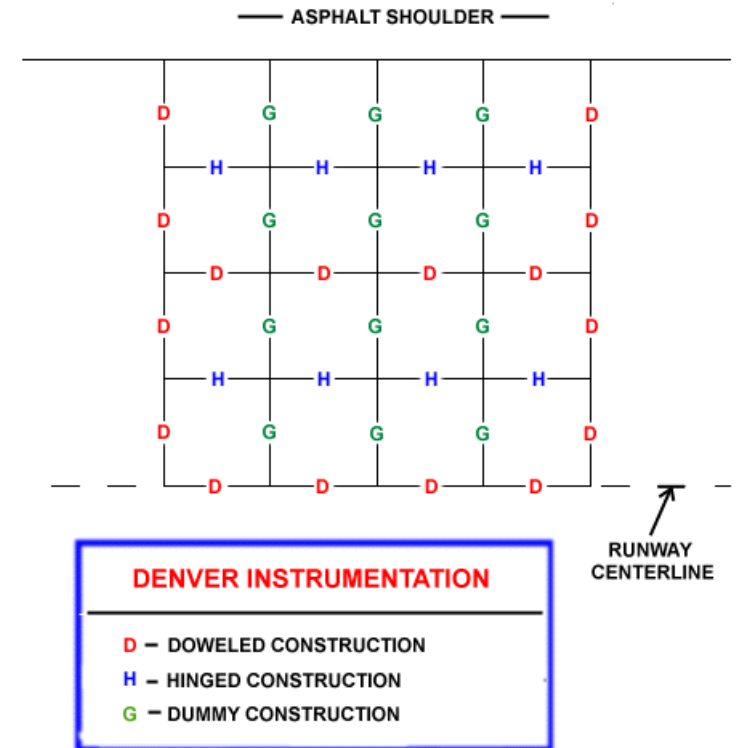
- Work Started in 1992
- 460 sensors installed
- Remote access est. 1994
- Automatic Data Collection and Periodic Site Visits from 1995 to 1999
 - Pavement Response under aircraft loads
 - Environmental parameters
 - Weather Conditions
 - Visual Pavement Inspections
 - Falling-Weight Deflectometer (FWD) Testing
 - Elevation Surveys



Research Projects

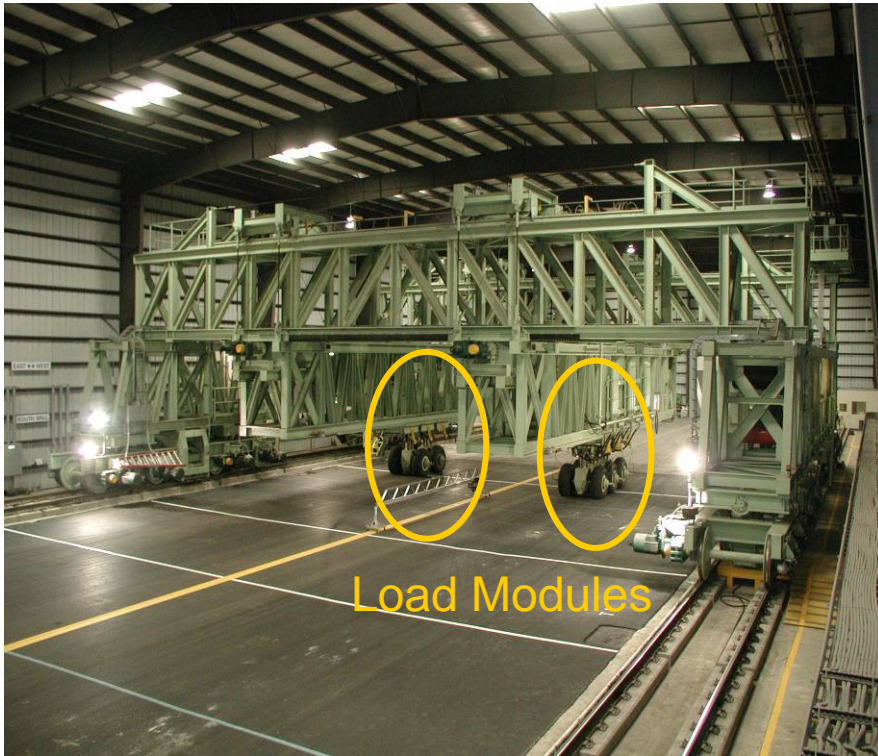
Field Instrumentation - DIA

- **Instrumentation**
 - Strain Gauges
 - Vertical Displacements
 - Aircraft Position, Speed and Acceleration
 - Environmental data



Facilities Upgrade

Pavement Testing Machine

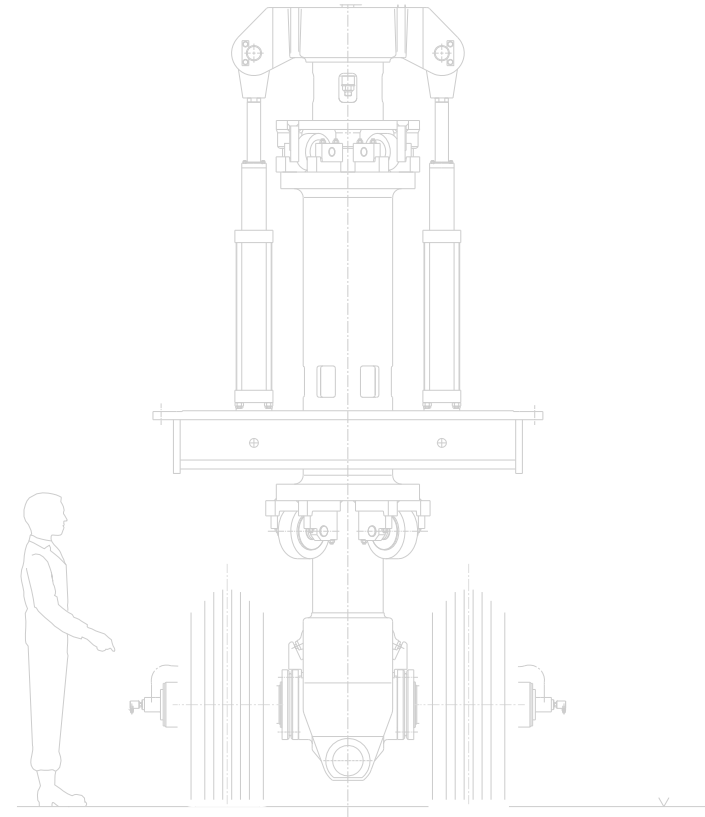


- Commissioned 1999
- Vehicle Weight = 1,200,000 lbs
- Max Tire Load = 75,000 lb (Per Tire)
- 16 Electric Motors - 48 HP Each
- Top Speed – 15 MPH
- Fully Programmable Load Control
- Fully Programmable Position Control
- Laser Data Communication System*
- 8 Camera Closed Circuit Video System*

Facilities Upgrade

Pavement Testing Machine

- **Purpose:**
 - Modify the NAPTF Test Vehicle to accommodate 8- and 10-wheel landing gear configurations.
 - Allow the FAA to conduct full-scale testing of future landing gear designs.
- **New Capabilities:**
 - +/- 5 degrees of steering.
 - Larger rims with redesign for tire removal/installation without bearing removal.
 - Radial tires with greater load capacity than current bias ply tires 66,500 versus 55,700 lb.



Facilities Upgrade Pavement Testing Machine



Disconnecting Existing Modules

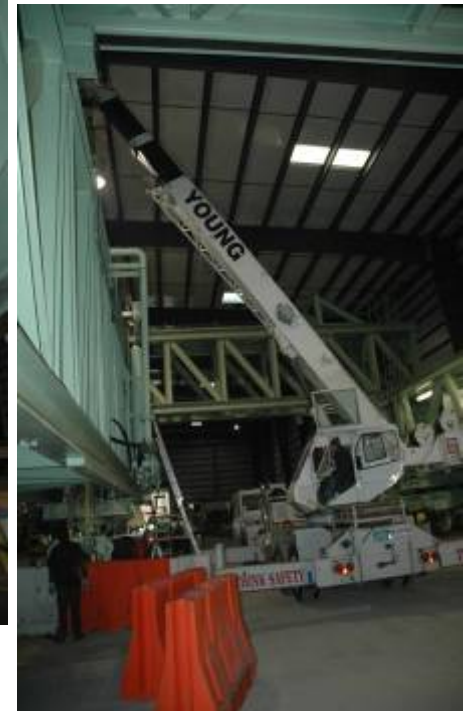
Facilities Upgrade

Pavement Testing Machine



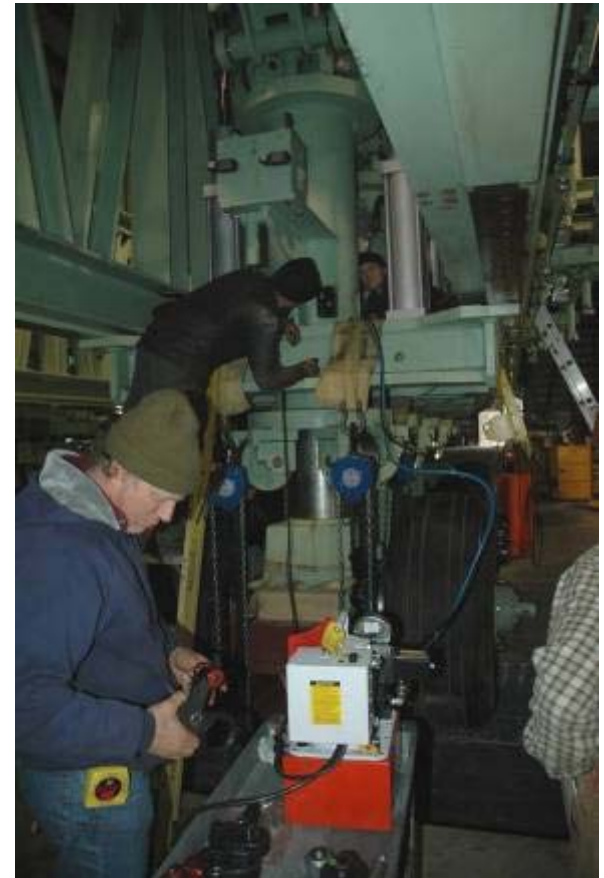
Relocating Existing Modules

Facilities Upgrade Pavement Testing Machine



Installing New Modules – Upper Section

Facilities Upgrade Pavement Testing Machine



Installing New Modules – Lower Section

Facilities Upgrade Pavement Testing Machine



North Carriage



South Carriage



Antonov AN-124-100

**New Module Installation Completed
December 2008**

Facilities Upgrade

Pavement Testing Machine



Electrical Work

Hydraulic Work

Facilities Upgrade Pavement Testing Machine



Existing Control Cab



Facilities Upgrade Pavement Testing Machine

New Control Cab



Facilities Upgrade

Pavement Testing Machine

- **Replace Bias Ply Tires and Manufacture New Rims on Existing Load Modules (12 Sets Required).**



Facilities Upgrade

Materials Testing Lab

- **Design Started – August 2006**
- **Bid Documents Completed – August 2008**
- **100% design review preformed by Philadelphia District Army Corps of Engineers**
- **USACE to administer the construction contract**
 - \$1.1 million estimated construction cost
- **FAA to provide construction oversight**
- **Projected contract award February 2009**



Facilities Upgrade

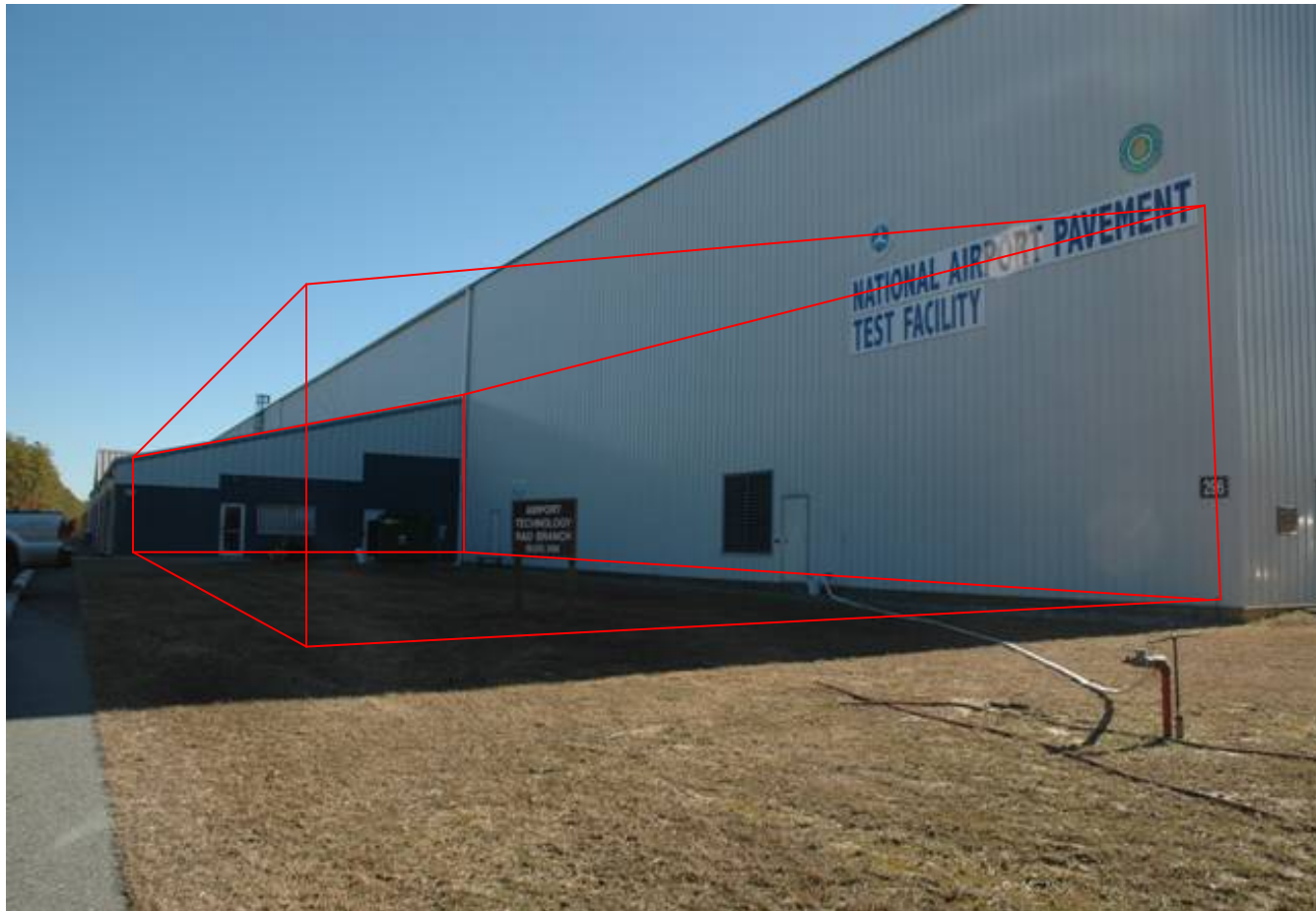
Materials Testing Lab

- **120 x 48 ft building (~5500 sq ft)**
- **Designed for Soils, Aggregates Concrete and Asphalt testing**
- **AMRL Certified**
- **CCRL Certified**
- **Material Testing for others**



Facilities Upgrade

Materials Testing Lab



Facilities Upgrade

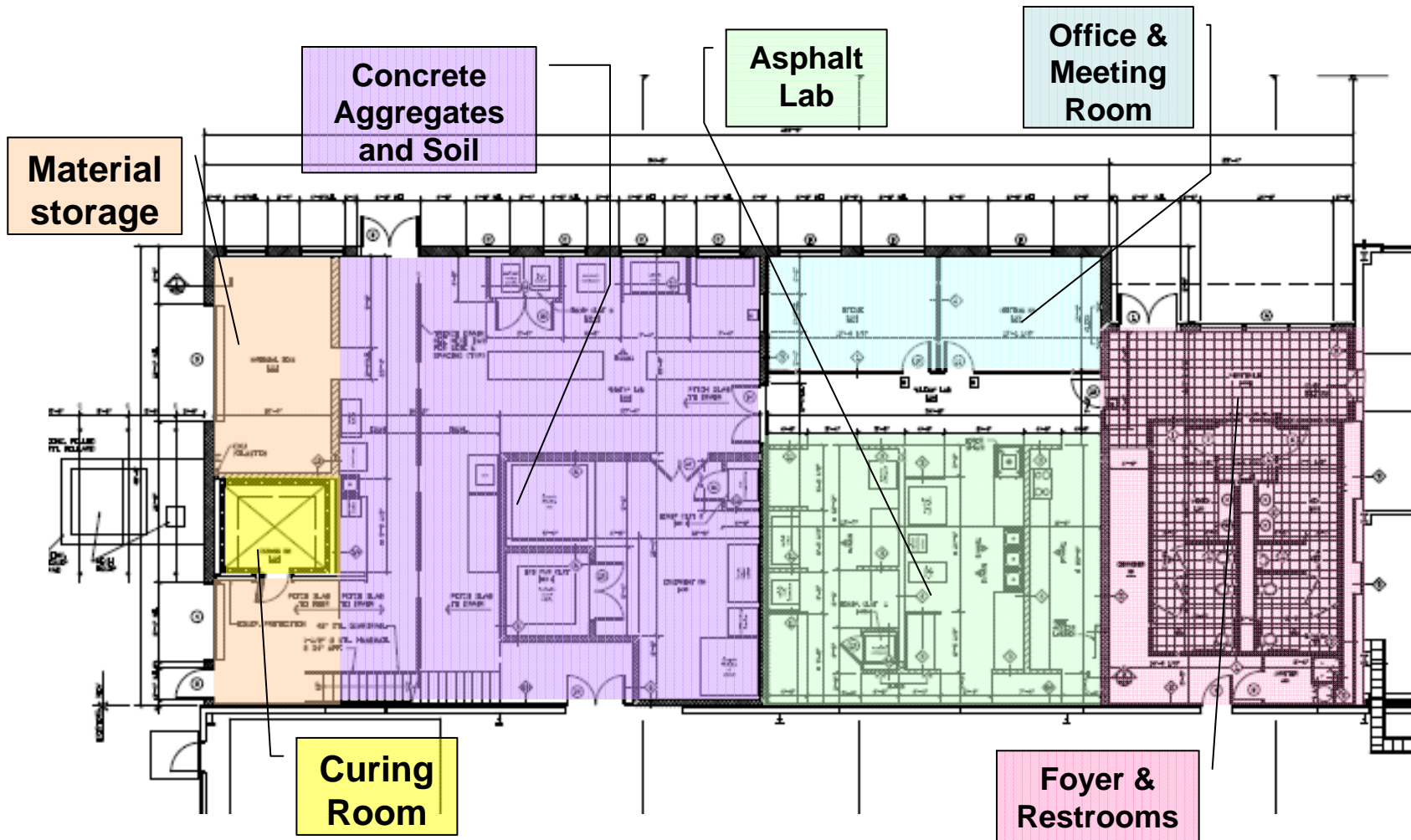
Materials Testing Lab



Facilities Upgrade Materials Testing Lab



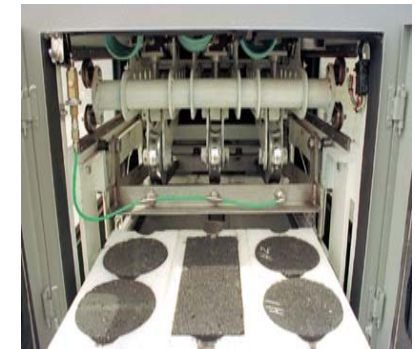
Facilities Upgrade Materials Testing Lab



Facilities Upgrade

Materials Testing Lab

- **Asphalt Pavement Analyzer (APA)**
- **Contact Pressure**
 - through rubber hose
 - Up to 250-psi
 - 100-psi (standard APA)
 - through aluminum wheels
 - Up to 500-psi
 - 200-psi (standard APA)
- **Variable rate of loading**



Facilities Upgrade

Heavy Vehicle Simulator

•Proposed Research Using HVS

- High Tire Pressure Testing
- Warm Mix Asphalt
- Stone Matrix Asphalt
- Asphalt Overlays of PCC
- Recycled Asphalt Pavement
- Polymer Modified Binders
- Shear failure of HMA



FEDERAL AVIATION ADMINISTRATION



F/HWD ROUND-UP 2010



MAY 2010

NAPTF - Atlantic City, New Jersey



2010 FAA WORLDWIDE AIRPORT TECHNOLOGY TRANSFER CONFERENCE

"NEXT GENERATION OF AIRPORT TECHNOLOGY"

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THANK YOU

QUESTIONS

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