Asphalt Pavement Association of Michigan (APAM) Annual Conference

February 26, 2025

Overview of the FHWA Mobile Asphalt Technology Center: Field Technologies On the Go

Bob Lauzon, Ph.D., PE
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Federal Highway Administration

U.S. Department of Transportation

Federal Highway Administration

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Acronyms

- AASHTO: American Association of State Highway and Transportation Officials
- AMPT: Asphalt Mixture Performance Tester
- ASTM: American Society for Testing and Materials
- BMD: Balanced Mix Design
- DPS: Dielectric Profiling System
- |E*|: Dynamic modulus of asphalt
- FHWA: Federal Highway Administration
- FTIR: Fourier Transform Infrared Spectroscopy
- I-FiT: Illinois Fatigue Test
- LTS: Laser Texture Scanner
- MATC: Mobile Asphalt Technology Center
- MPD: Mean Profile Depth
- NDE: Nondestructive Evaluation
- PMTP: Paver Mounted Thermal Profiler
- QA: Quality Assurance
- SSR: Stress Sweep Rutting
- TFHRC: Turner-Fairbank Highway Research Center
- XRF: X-Ray Florescence

MATC Presentation Overview

Introduction
Mission
Site Visits
Demo Technologies
- Thermal profiler
- Laser Texture Scanner
- Pulse Induction Scanner
- Density Profiler

Information Outreach
Lunch and Learn
Equipment Loan Program
Specification Review
Summary/Questions

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Federal Highway Administration

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Acting Federal Program Manager

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Project Engineer
Data Analysis
Performance Testing

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Field Testing

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FHWA Resource Center

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Senior Project Engineer
Specification Reviews
Technical Writing and Presentation

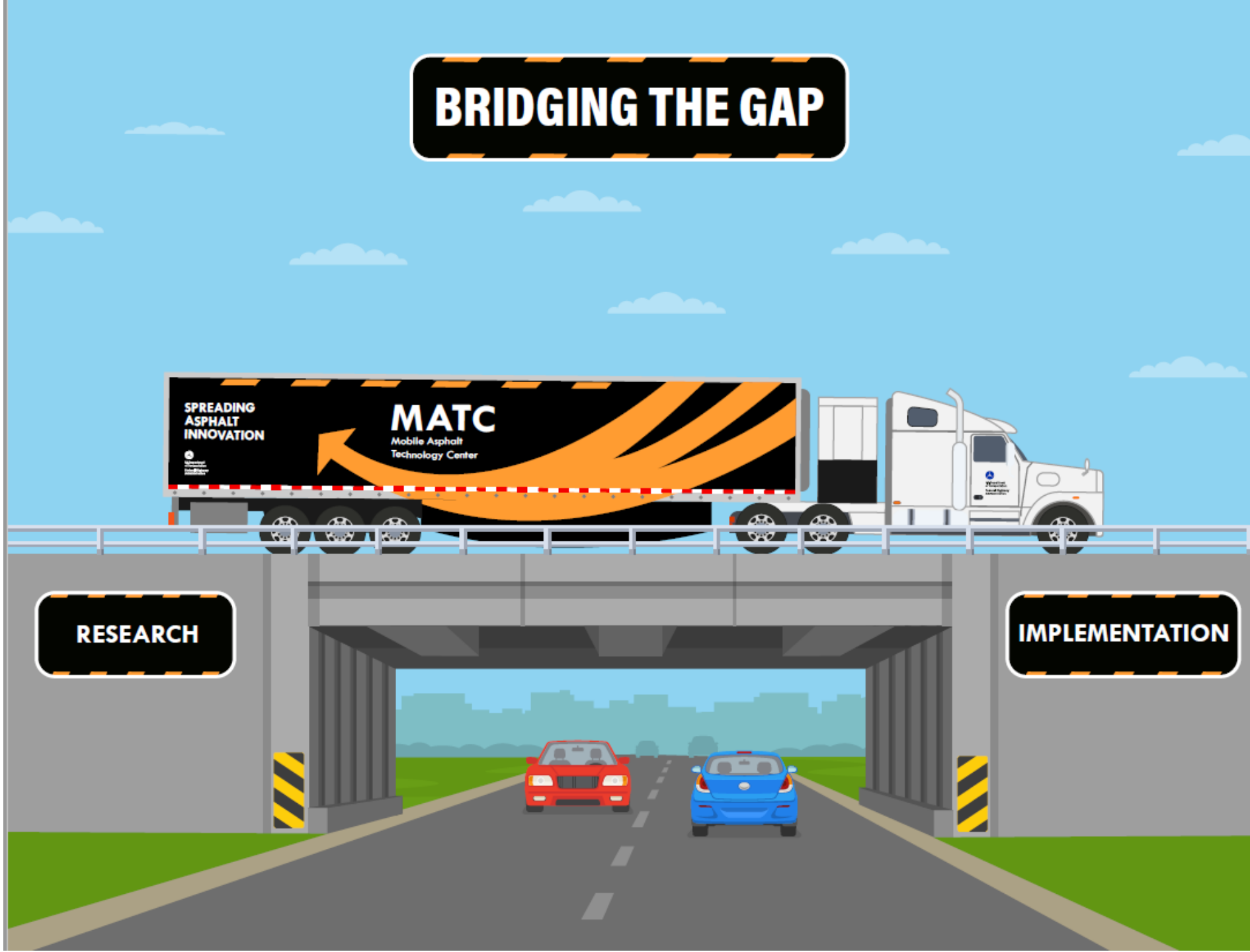
James Barker
Laboratory Technician
Electro/Mechanical
Mixture Design/Testing

SME: Nam Tran
Subject Matter Expert
Asphalt Materials Data Analysis

MATC Mission

Mission

For the benefit of the Agency and the Industry



Site Visits

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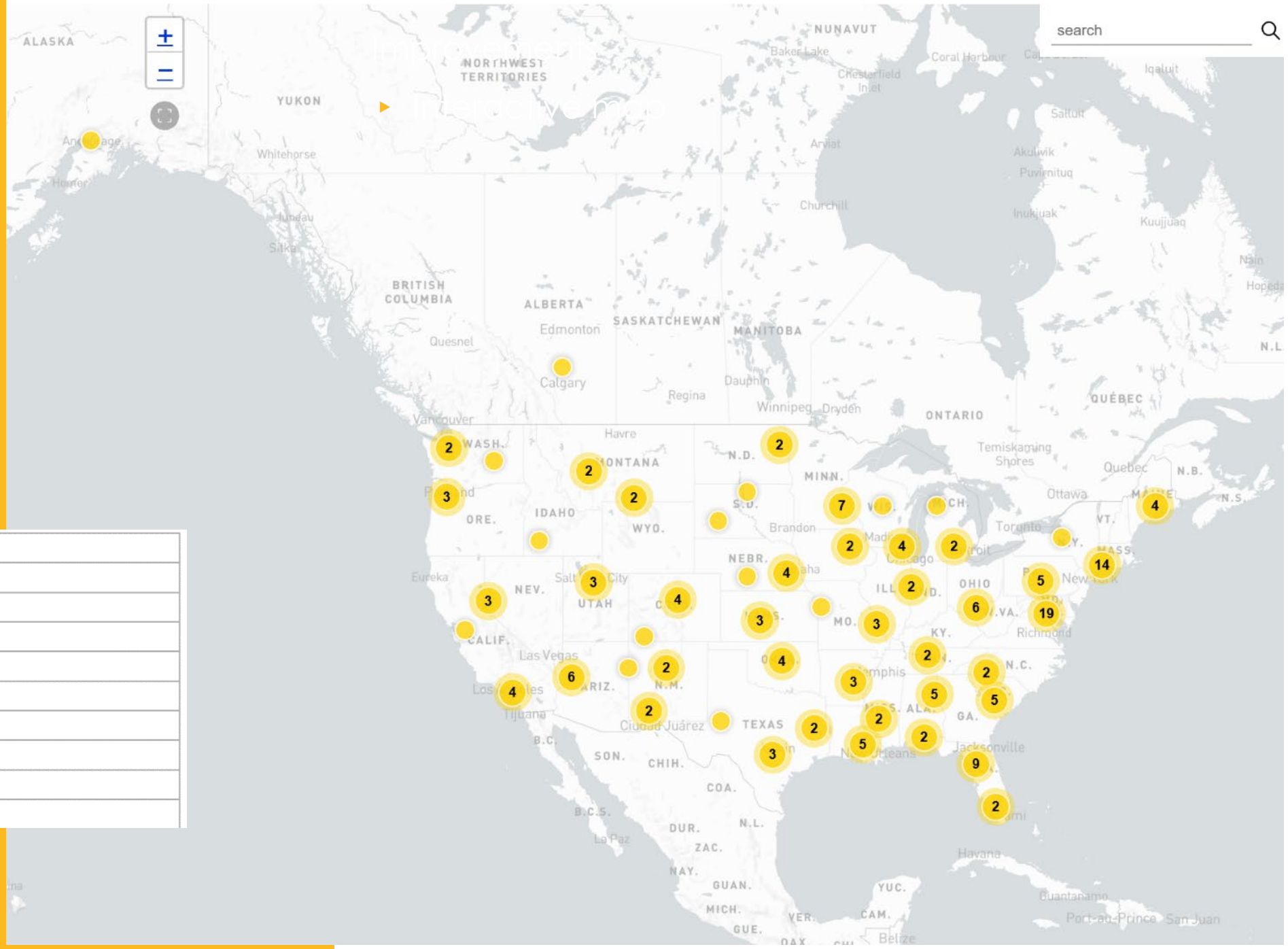
Site Visits

Since 1988

- Interactive Map
- Searchable:

RAP	Reclaimed asphalt pavement
RAS	Recycled asphalt shingles
SMA	Stone matrix aggregate mix design
FC	Friction course
WMA	Warm mix asphalt
Hi-RAP	High percentage of RAP (30% plus)
PMA	Polymer modified asphalt
AR	Asphalt rubber
ARB	Asphalt rubber base
PRS	Performance related specification project



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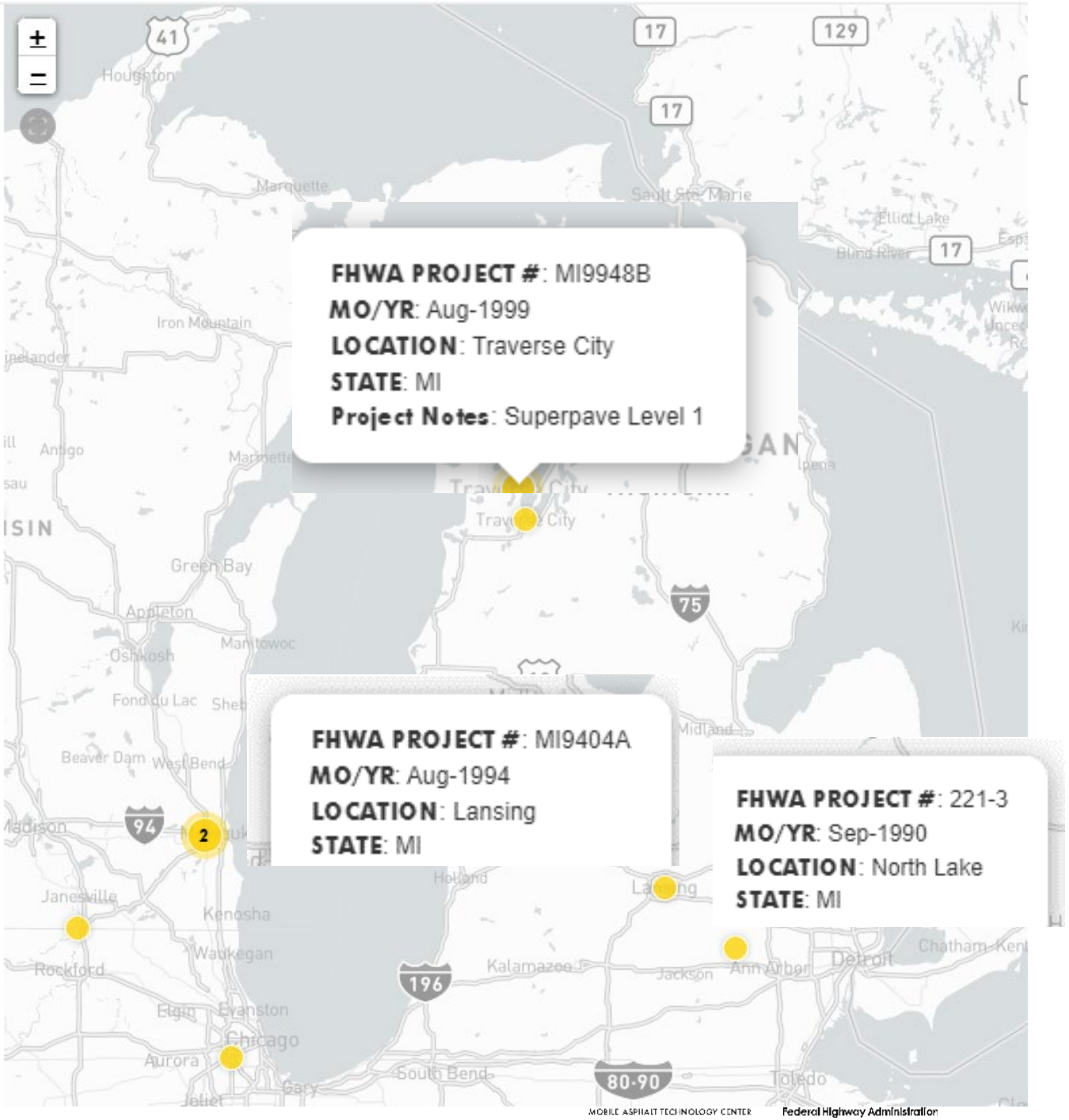
Michigan Site Visits

- *North Lake 1990*
- *Lansing 1994*
- *Traverse City 1999*



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TYPICAL SITE VISIT Timeline
BY MATC

Total Time: 12 months

Onsite Time: 3-4 weeks

Kickoff Meeting
with DOT and FHWA Div.

1.5-hr virtual overview of MATC Program

Planning Meetings
with DOT and Contractor

Starting 3 – 4 months prior (emails, calls, virtual meetings)

On-Site Kickoff
with DOT, Contractor, and FHWA Div. on-site

Typically held the week prior or 1st week on-site

Open House
with DOT, SAPA members, LPAs, ACEC, etc.

1st or 2nd week on-site Formal presentations and MATC tours

On-Site Testing
at Plant and Field sites

2 – 3 weeks at MATC Lab and Paving Site

On-Site Closeout
with DOT, Contractor, and FHWA Div. on-site

During last week of site visit

Final Report & Quality Workshop
with DOT, Contractor, SAPA, and FHWA Div.

Report: 90 days post-visit
Workshop: 6-9 months

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Test Plan for Site Visit (example)

Mixture Testing		Asphalt Binder Testing	Field Testing Demonstrations
Volumetrics	**Performance Testing**		
Asphalt Content by Ignition	IDEAL-CT (CT)	Performance Grading AASHTO M 320 & M 332	Paver-Mounted Thermal Profiler (PMTP)
Gradation	IDEAL-CT (Aged)	20-hr PAV Aging 40-hr Extended Aging ΔT_c Testing	Dielectric Profiling System (DPS)
Mixture Gravities (G_{mb} & G_{mm})	IDEAL-RT (RT)	XRF & FTIR Spectroscopy	Pulse Induction Technology (thickness)
VTM, VMA, VFA, and D/A	Hamburg Wheel Track Testing (HWTT)	Asphalt Binder Quality Tester (ABQT)	Laser Texture Scanner (MPD)

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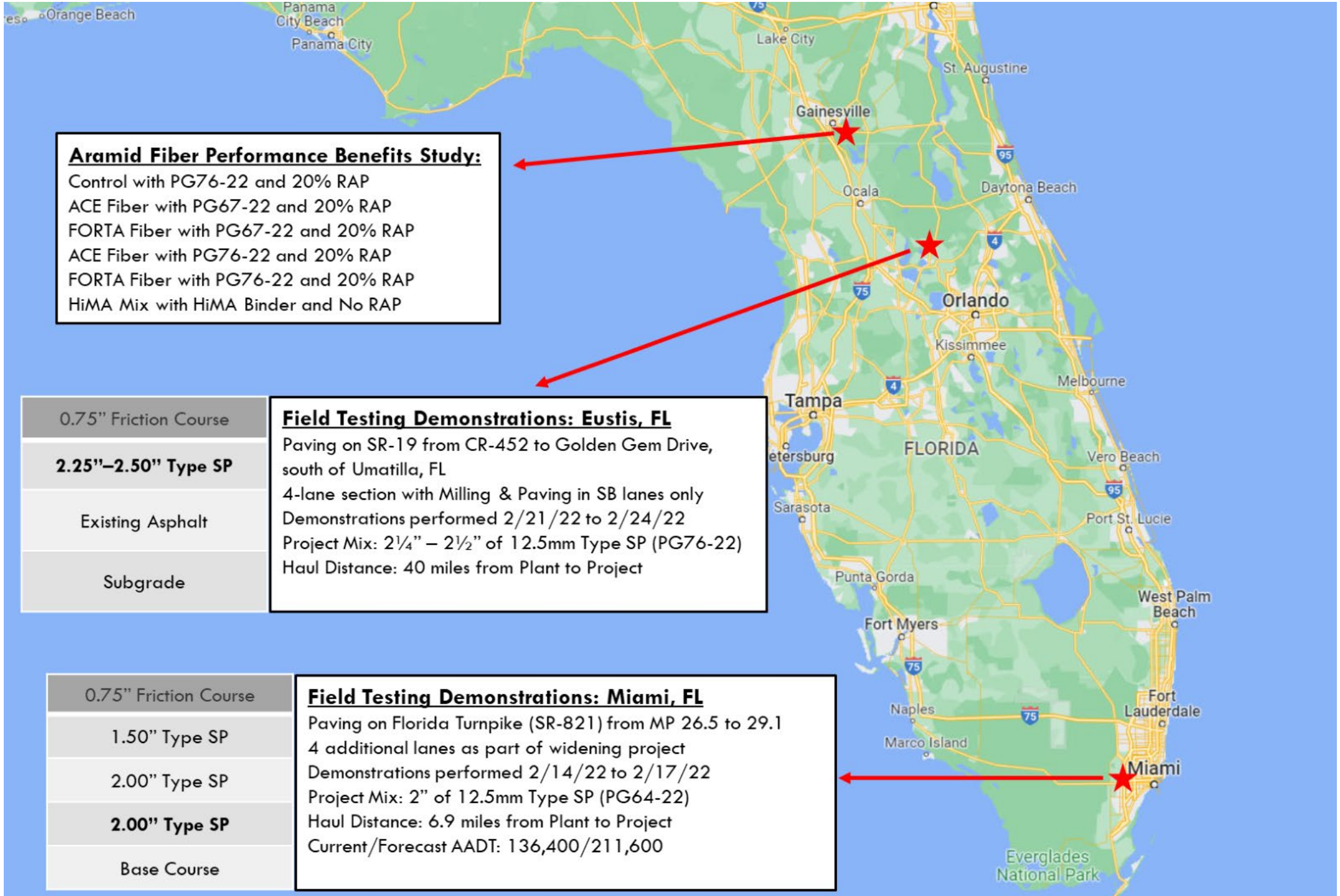
Example of Typical MATC Site Visit

- - - - -

Feb 2022



Aramid Fiber Performance Benefits Study:

Control with PG76-22 and 20% RAP
ACE Fiber with PG67-22 and 20% RAP
FORTA Fiber with PG67-22 and 20% RAP
ACE Fiber with PG76-22 and 20% RAP
FORTA Fiber with PG76-22 and 20% RAP
HiMA Mix with HiMA Binder and No RAP

0.75" Friction Course
2.25"–2.50" Type SP
Existing Asphalt
Subgrade

Field Testing Demonstrations: Eustis, FL

Paving on SR-19 from CR-452 to Golden Gem Drive, south of Umatilla, FL
4-lane section with Milling & Paving in SB lanes only
Demonstrations performed 2/21/22 to 2/24/22
Project Mix: 2¼" – 2½" of 12.5mm Type SP (PG76-22)
Haul Distance: 40 miles from Plant to Project

0.75" Friction Course
1.50" Type SP
2.00" Type SP
2.00" Type SP
Base Course

Field Testing Demonstrations: Miami, FL

Paving on Florida Turnpike (SR-821) from MP 26.5 to 29.1
4 additional lanes as part of widening project
Demonstrations performed 2/14/22 to 2/17/22
Project Mix: 2" of 12.5mm Type SP (PG64-22)
Haul Distance: 6.9 miles from Plant to Project
Current/Forecast AADT: 136,400/211,600

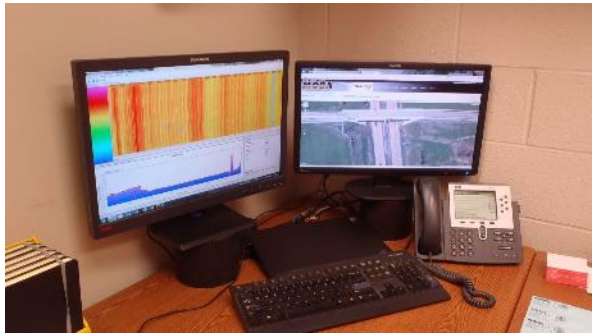
Demonstration of Field Technologies

Paver Mounted Thermal Profiler (PMTP)

Paver-Mounted Thermal Profiler (PMTP)

Paver Mounted Display

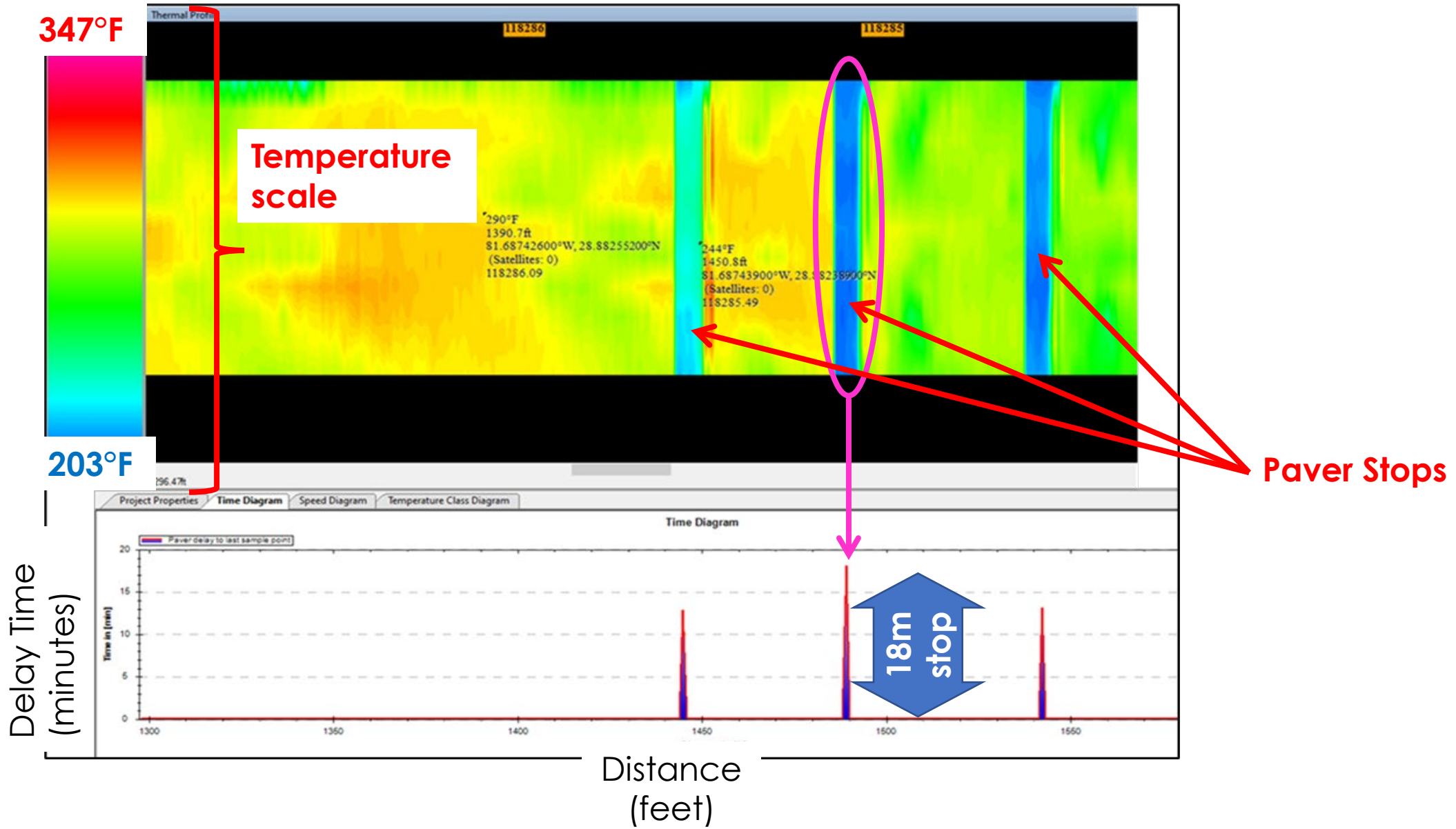
Office location



Imaging of Mat Surface: 2 to 3 meters behind screed

All images source: Travis Walbeck

PMTP Thermal Map: SR-19 near Eustis, FL



Use of PMTP Devices Nationally

Benefits

+ Identify cold spots, segregation, thermal streaks
+ Identify low density areas
+ Control paver delays
+ Adjust paver speed between delivery trucks

Current Limitations

- Installation on contractor's equipment
- Direct correlation between severe thermal segregation & pavement density currently lacking

Implementation in 12 States & Eastern Federal Lands

- Alabama, Alaska, Illinois, Maine, Minnesota, Missouri, New Jersey, North Carolina, North Dakota, Texas, Virginia, & West Virginia

Demonstration of Field Technologies

Laser Texture Scanner

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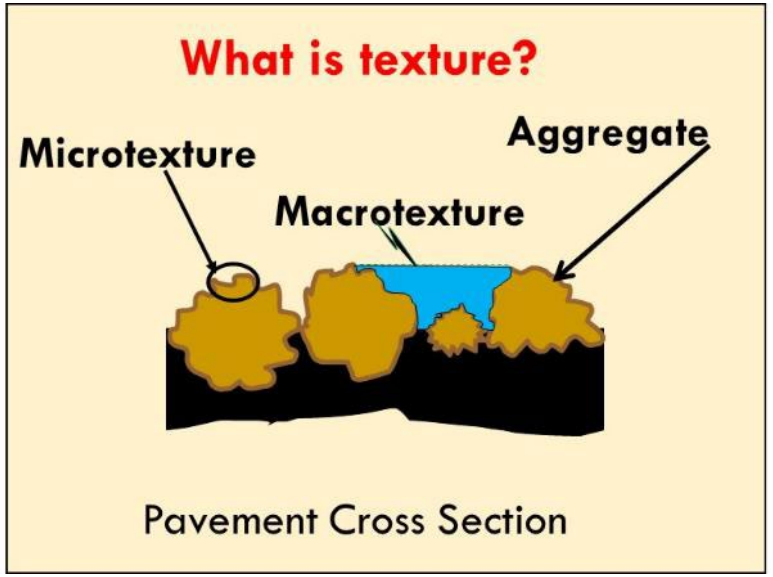
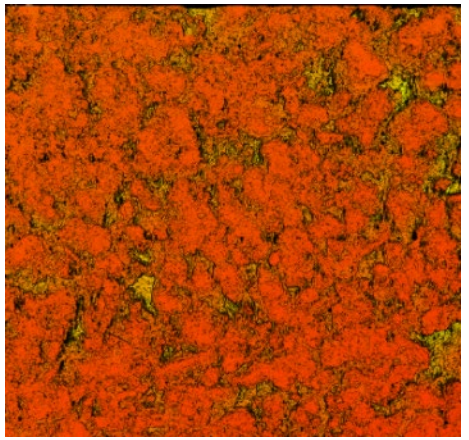
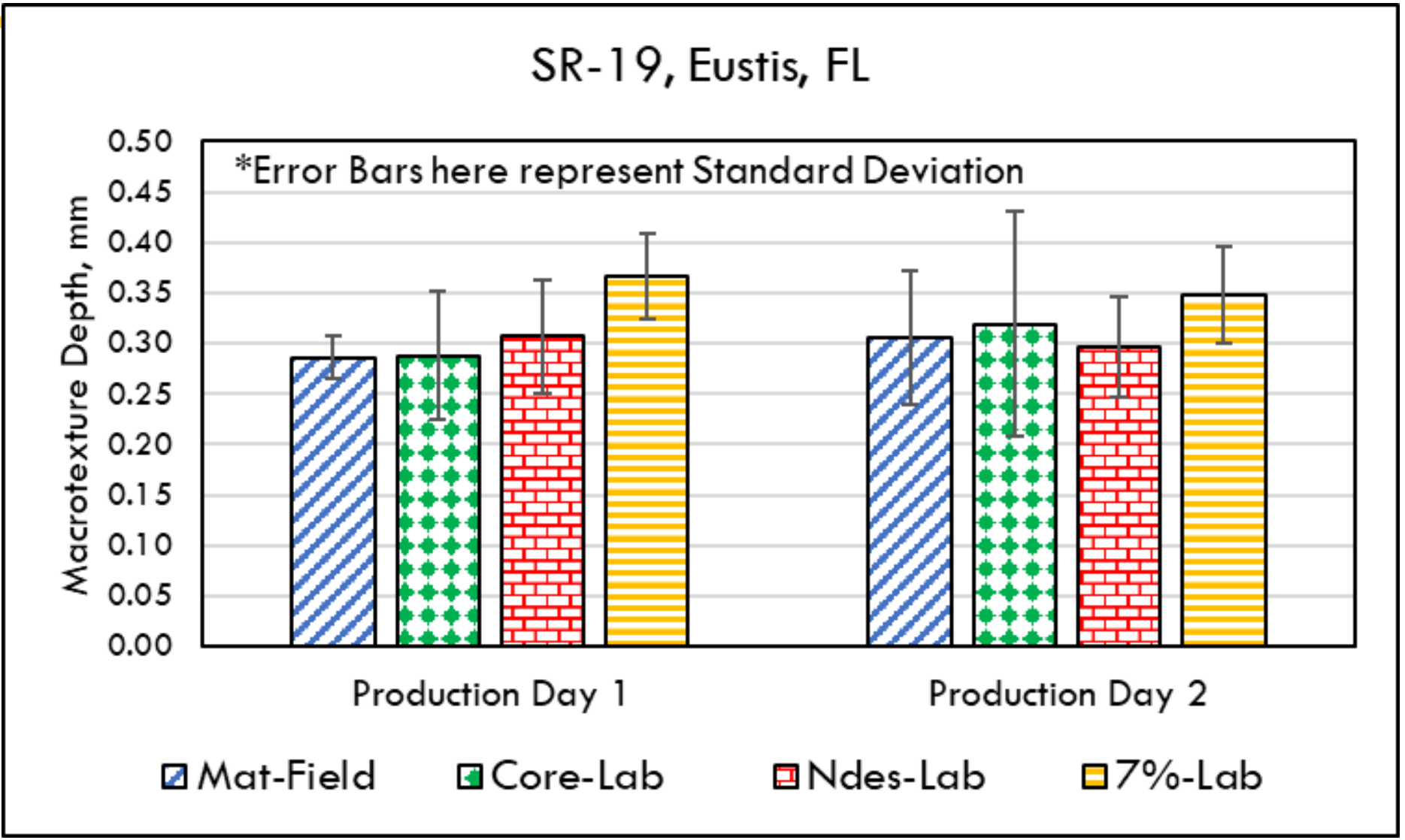
Laser Texture Scanner: Use in Lab or Field



- Lightweight, portable, rapid, 3D scanner
- Utilizes a 100-mm laser line and travels 100 mm to collect a square area
- Measures macrotexture on freshly compacted mats in field and on cores or gyratory specimens in lab



Mean Profile Depth (MPD) Measurements SR-19 near Eustis, FL



12.5mm Dense Fine-Graded HMA **– typical MPD values between 0.4 to 0.8 mm** - according to 2022 AASHTO Guide for Pavement Friction

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Laser Texture Scanning

Benefits

+ Easy to use & nondestructive
+ High accuracy
+ Takes 90 seconds to run
+ Good for QC use
+ Can be used in lab during mix design & production

Current Limitations

- Standards still under development
- Surface must be dry, if used on field mat
- Sensitive to shiny mixes so spray needed to dull reflectance
- Not a direct correlation to friction

Currently under consideration for implementation

- California, Illinois, Kentucky, North Carolina, Ohio, Washington

Demonstration of Field Technologies

Pulse Induction Technology

Pulse Induction Technology

Nondestructive Pavement Measurement

- Quality control and agency acceptance
- AASHTO test method (AASHTO T 359-18)
- ASTM test method in the works
- *Use of this test method is not a Federal requirement*

Step 1

Place the target

Step 2

Pave over it

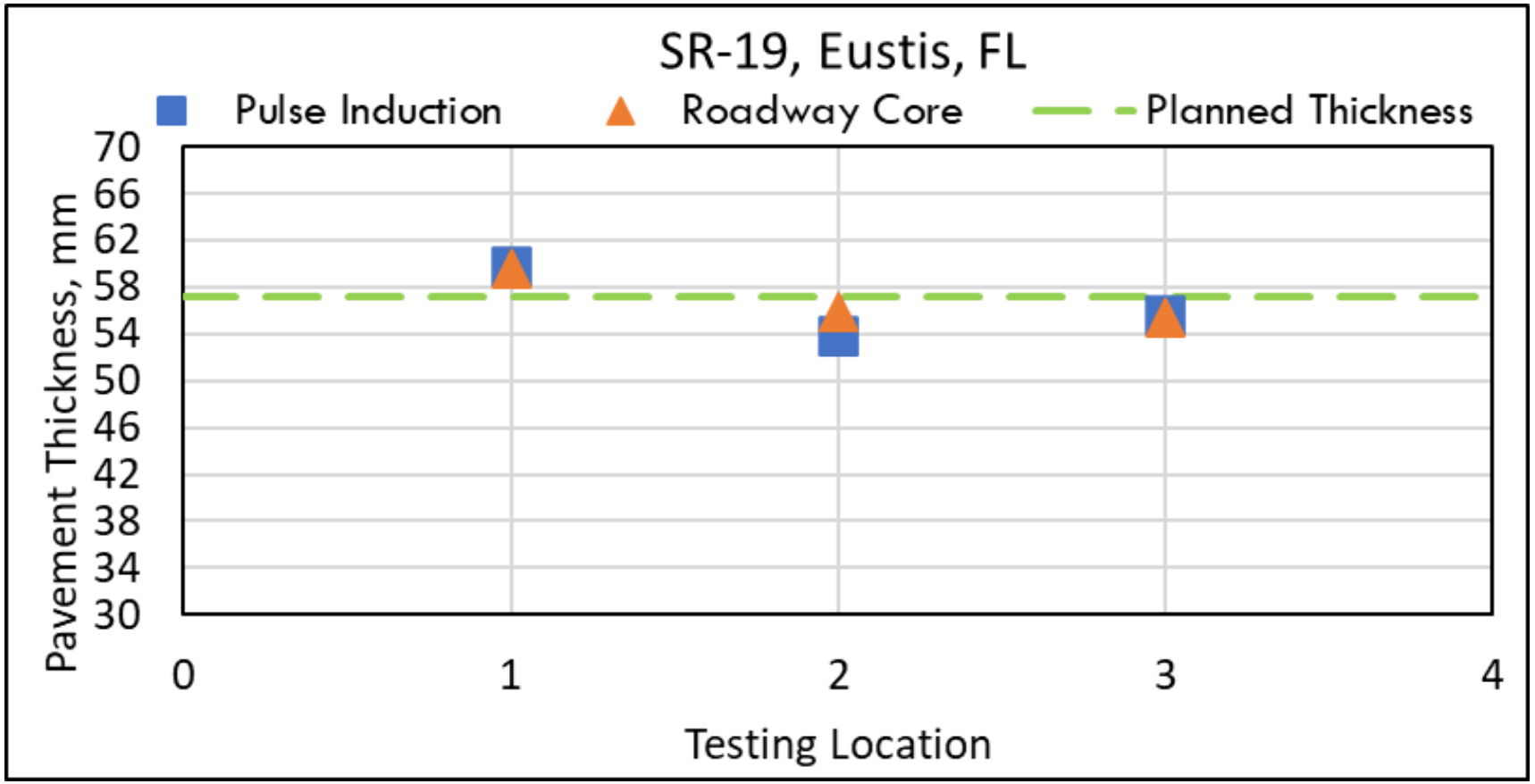
Step 3

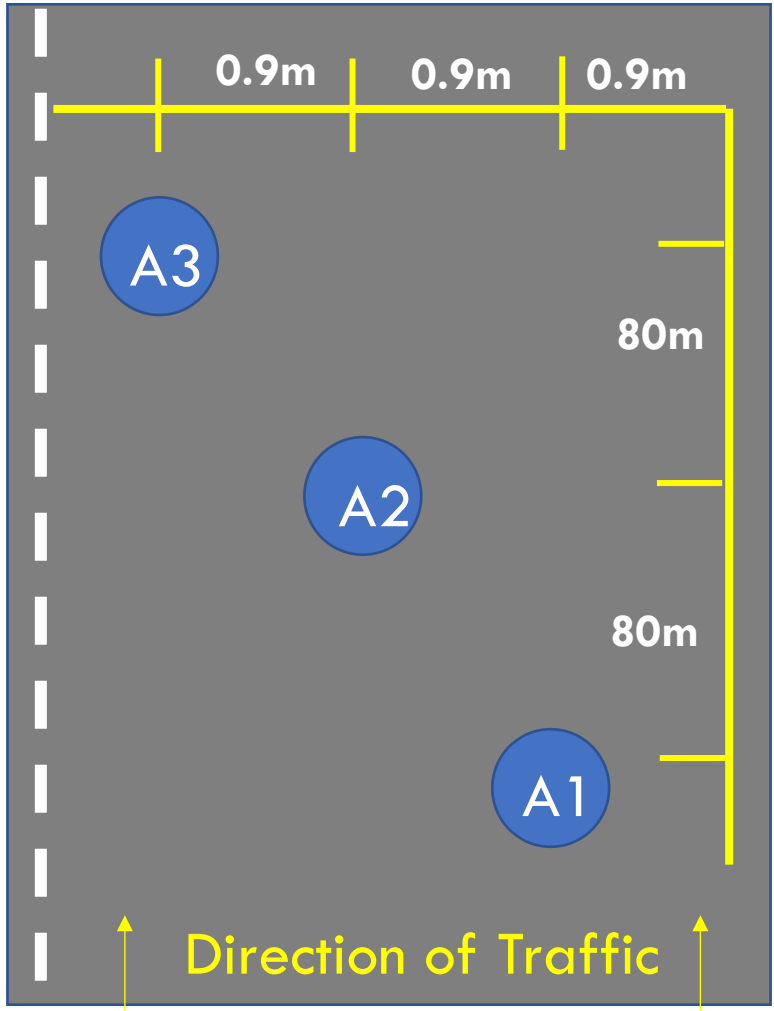
Find targets; measure thickness

Optional Step

Core & confirm thickness

Pulse Induction Technology - SR-19 near Eustis, FL





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Pulse Induction Technology

Benefits

+ Easy to use
+ High accuracy
+ Non-destructive
+ Almost real time (rapid)
+ Good for QC use e.g., test strips, informing paver adjustments

Current Limitations

- Presence of existing rebar in existing layers
- Presence of excessive moisture on surface
- Windrow paving
- Surface irregularities (inadequate removal of scabs, unlevel existing surface)

Current practice

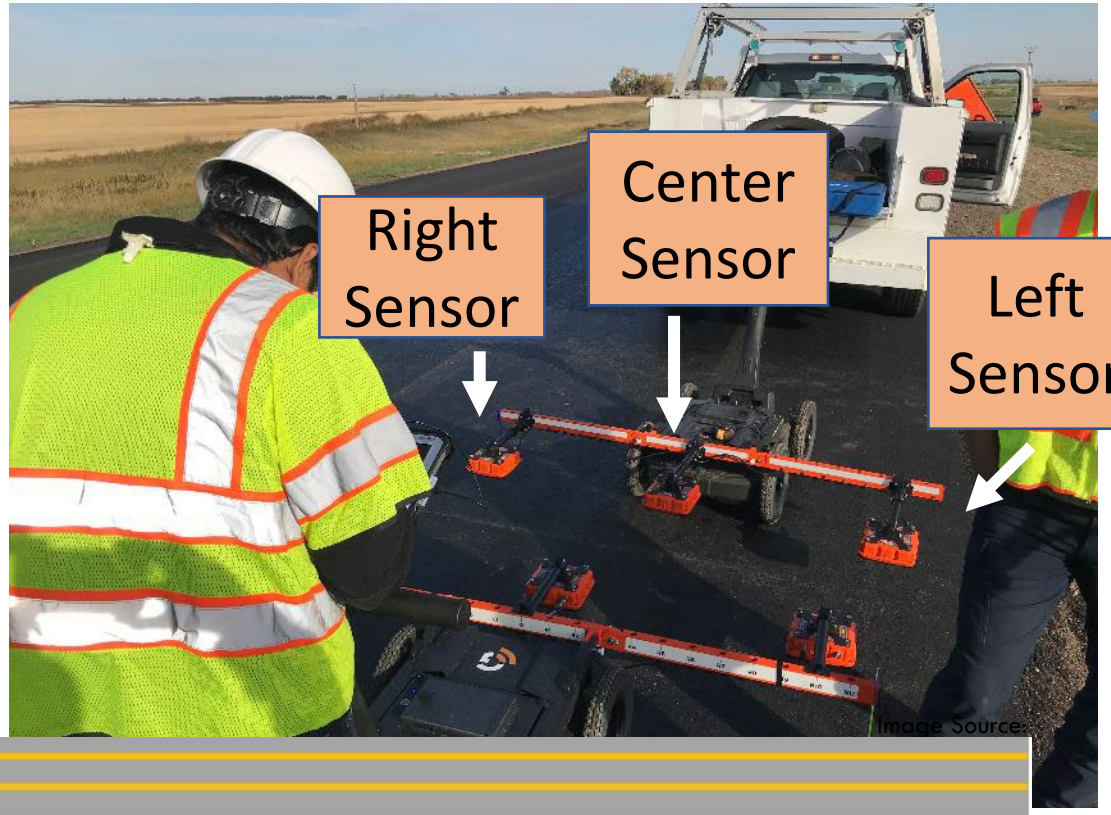
- Iowa, Minnesota, Pennsylvania, Washington, Wisconsin

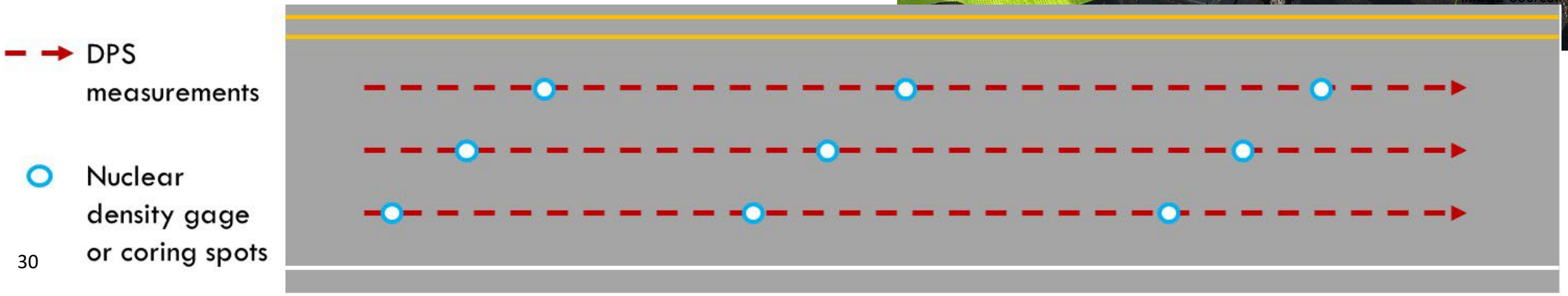
Demonstration of Field Technologies

Density Profiler

Dielectric Profiling Systems (DPS)

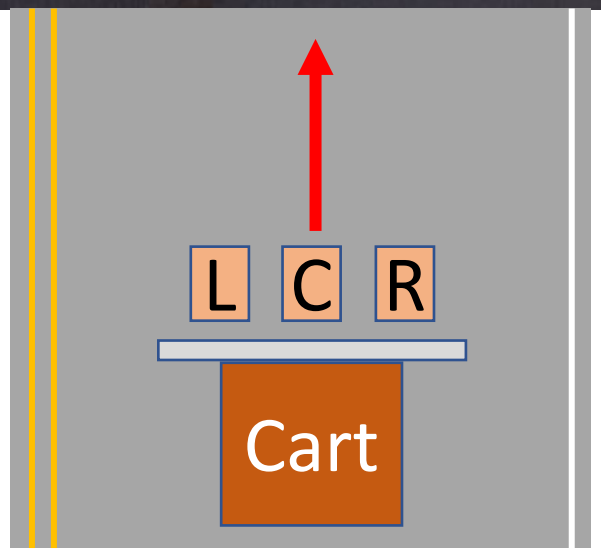
- Coring and nuclear density gauge only used for spot checks on predetermined, random locations
- DPS provides continuous density profile along testing path
- Reduce turnaround times



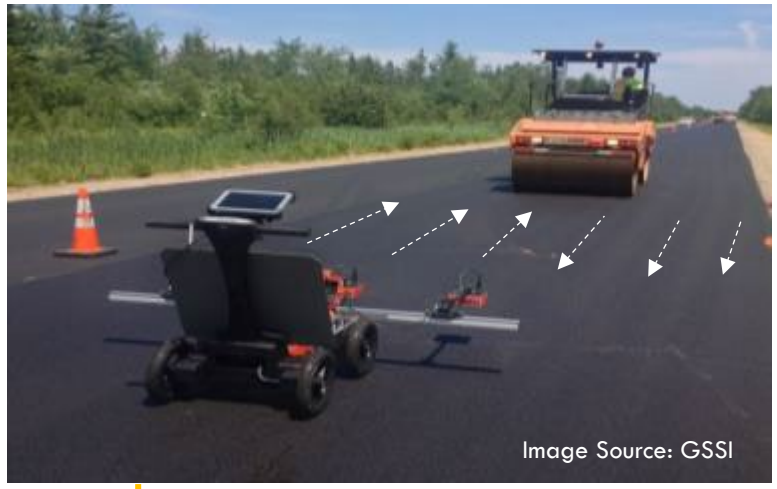


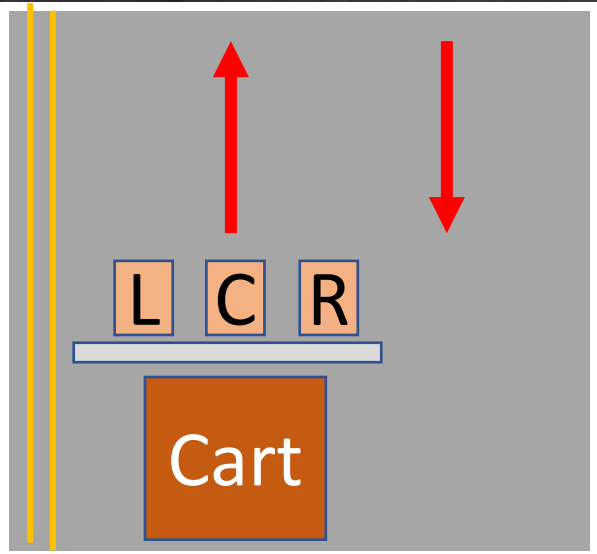
Data Collection Patterns

1-Pass Pattern

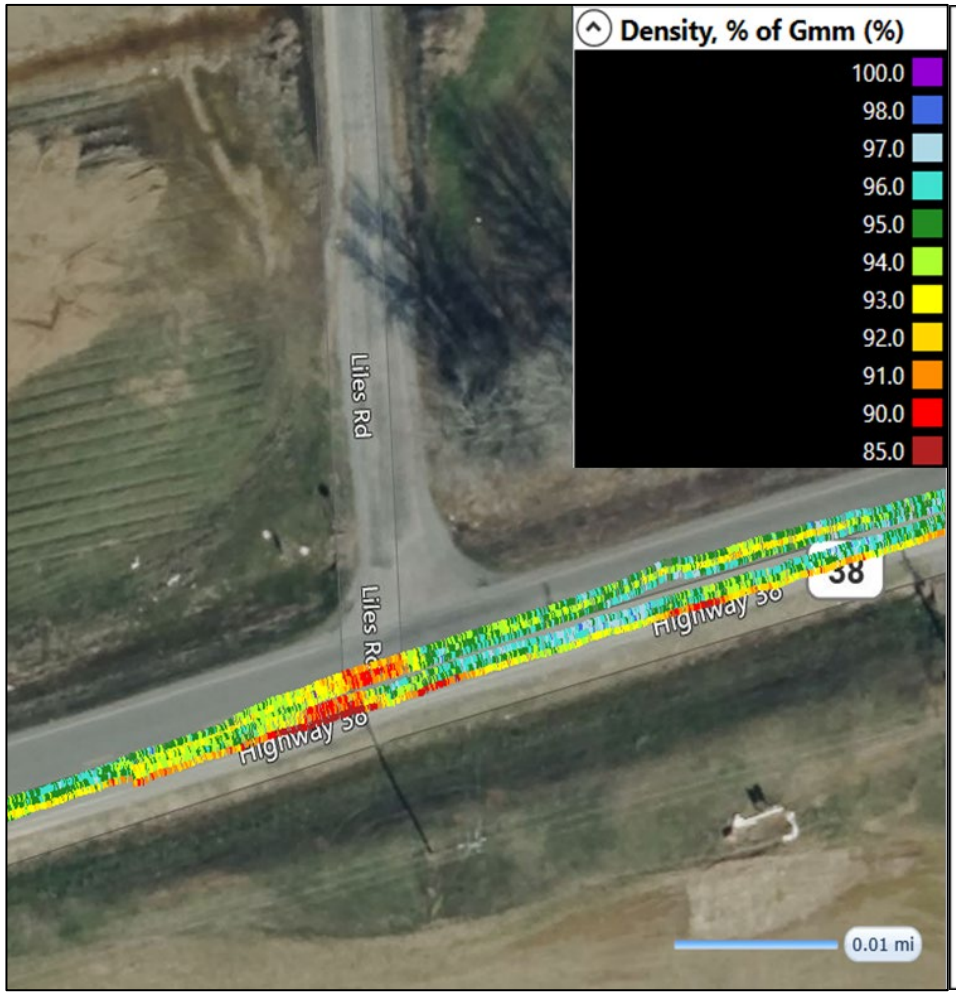


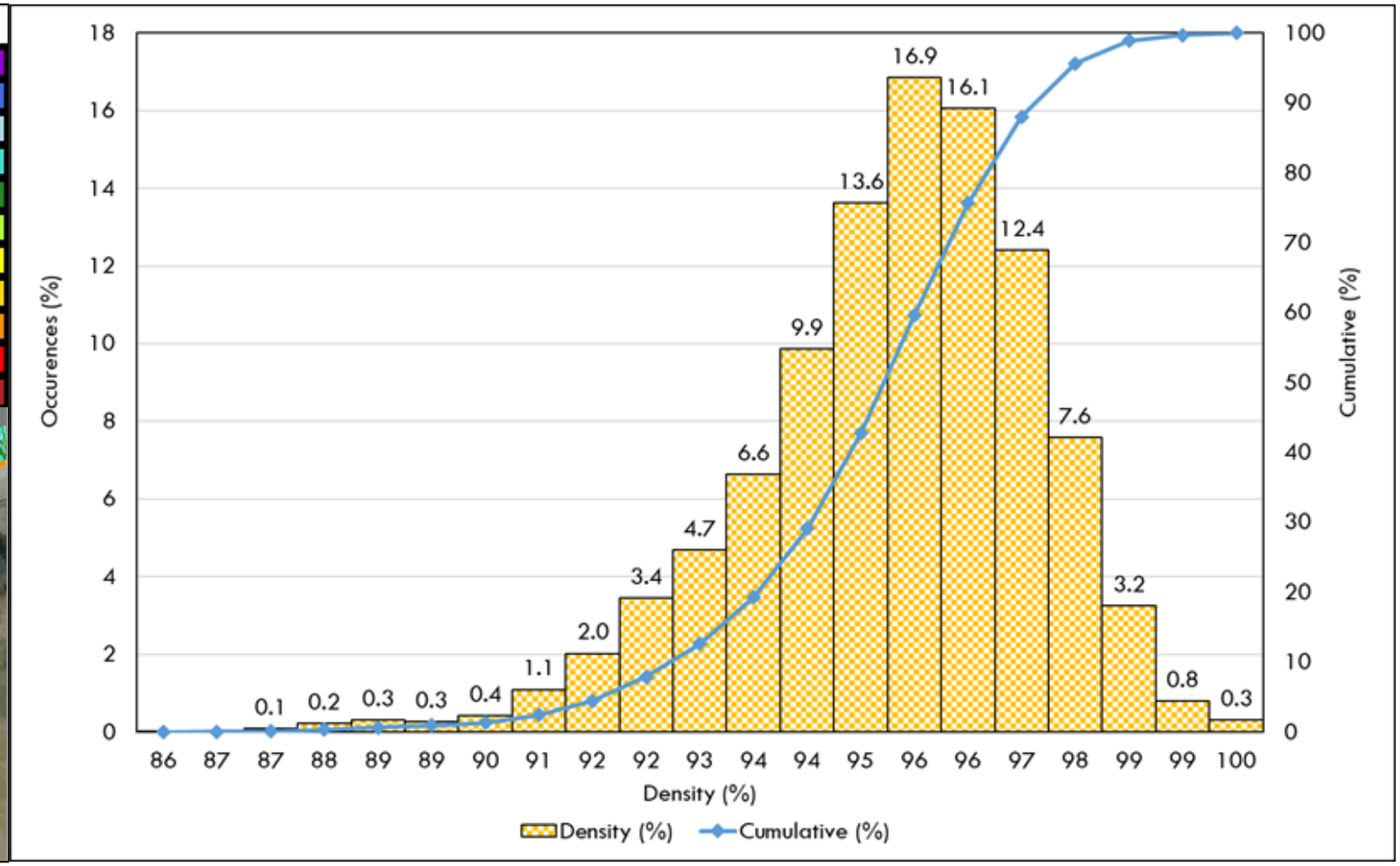
2-Pass Pattern





DPS Mapping & Predicted Density Distribution





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Benefits and Challenges of DPS

Benefits

+ Use as QC tool to identify potential issues with paving & compaction operations
+ Nondestructive
+ Helps identify high and low compaction areas
+ Help improve density of mat & longitudinal paving joints

Current Challenges

- Obstacles to use for acceptance (agency resources, proper validation of contractor data, time to collect, etc.)
- Incorporation in specifications & bids
- Staffing the data collection
- Device is run manually

Density Profiling System - Office of Materials and Road Research - MnDOT (state.mn.us)

Information Outreach

Information Outreach

U.S. Department of Transportation
Federal Highway Administration

Spotlight on Pavement Density

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Use of Dielectric Profiling Systems for Asphalt Density

FHWA-HIF-21-XXXX

For more information on DPS and related technology, contact Monica Jurado, Pavements & Materials Engineer, FHWA Resource Center, monica.jurado@dot.gov

This equipment and more are available on loan at the MATC. www.fhwa.dot.gov/pavement/asphalt/trailer/equipment_loan_program.pdf

The dielectric profiling system series shares information on pavement testing programs.

To access the full series, visit www.fhwa.dot.gov/pavement/asphalt/trailer/initiatives.cfm

Background

Highway agencies seeking a more viable way to check the quality of asphalt construction than through sample cores are considering dielectric profiling systems (DPS) as a solution.

DPS use a ground-penetrating radar (GPR) to collect dielectric values from the underlying surface that help measure air voids or nonuniformity of newly laid hot-mix asphalt. In this way, a DPS unit rolled along a road segment can collect continuous data on asphalt density. Asphalt density is a key indicator for long-term performance of new pavement or resurfacing construction jobs. Improving pavement performance can extend maintenance cycles and save millions of dollars in transportation budgets.

State Departments of Transportation (DOTs) have been field-testing DPS units in their pavement testing programs through the second Strategic Highway Research Program (SHRP2) Initiative (R06C), which advanced the DPS technology as a nondestructive method for checking asphalt density.

DOTs describe initial difficulties in interpreting the intricate data and managing the enormous data output. However, DOTs observe that the data produces a more uniform and immediate picture of a new pavement layer than the process of obtaining sample cores at random spots along a new section.

A DPS unit side view (above) and in use (below). Photo sources: GSSI; ODOT

How DPS Work

DPS units come in various models from multiple commercial vendors, costing about $70,000 per unit. Also known as density profiling systems, they often are in the form of lightweight carts that one person easily pushes along a test path. A three-channel GPR mounted near the wheels continuously collects data that transmits to the unit's computer system.

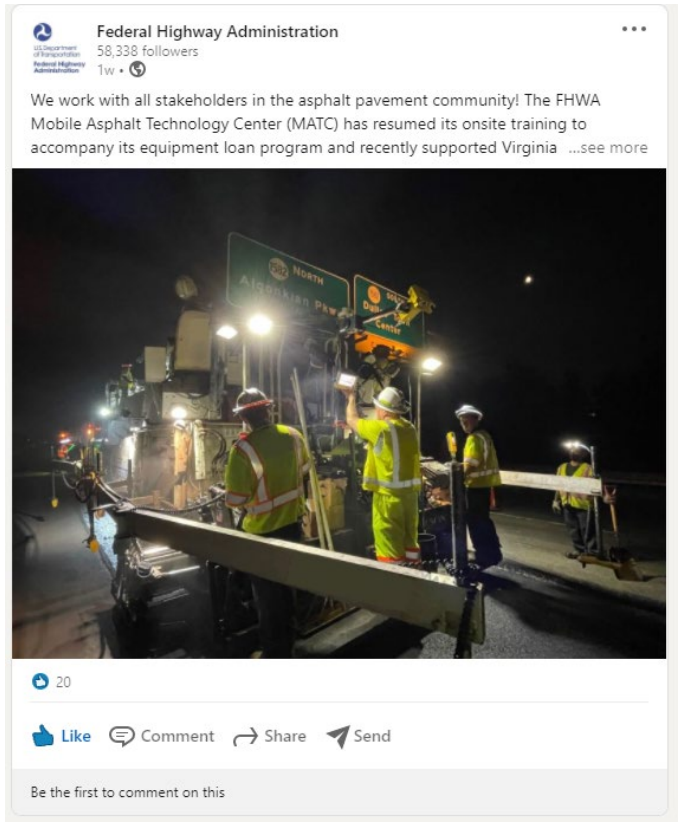
The unit determines the dielectric readings of the materials that make up the asphalt layer by measuring the velocity of reflected waves to about 2.5 inches. All material has a dielectric constant, ranging from 1 for air to 81 for water. HMA dielectric constants typically range from 3 to 6, depending on the aggregate type, asphalt content, and percentage of air voids.

The paving crew can view the data immediately on the unit's trackpad and then export the data to other software for further analysis. The dielectric constants along the test path display as statistical data, histograms, box plots with outliers identified, or heat maps of the production lot.

Considering DPS? Technical assistance is available from the Federal Highway Administration (FHWA) through the Mobile Asphalt Technology Center (MATC) or FHWA division offices. There is also a national pooled fund study on DPS use.

Benefits

- Ability to detect and identify areas of concern. Contracting crews can adjust or remediate while the work zone is intact and before a job's acceptance.
- More uniform results than with sample cores, which may miss variations in the new mat.
- Significant reduction of cores per project. This avoids risks of new defects from removal and return of cores. It also can save on contract costs.
- Data applies to other uses, such as simulating changes to construction specifications, mapping locations and data, and other quick visualizations.
- More efficient and safer than coring. A DPS unit can be walked behind the paving equipment without additional road closures against fast-moving traffic.



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58,338 followers
1w •

We work with all stakeholders in the asphalt pavement community! The FHWA Mobile Asphalt Technology Center (MATC) has resumed its onsite training to accompany its equipment loan program and recently supported Virginia ...see more

20

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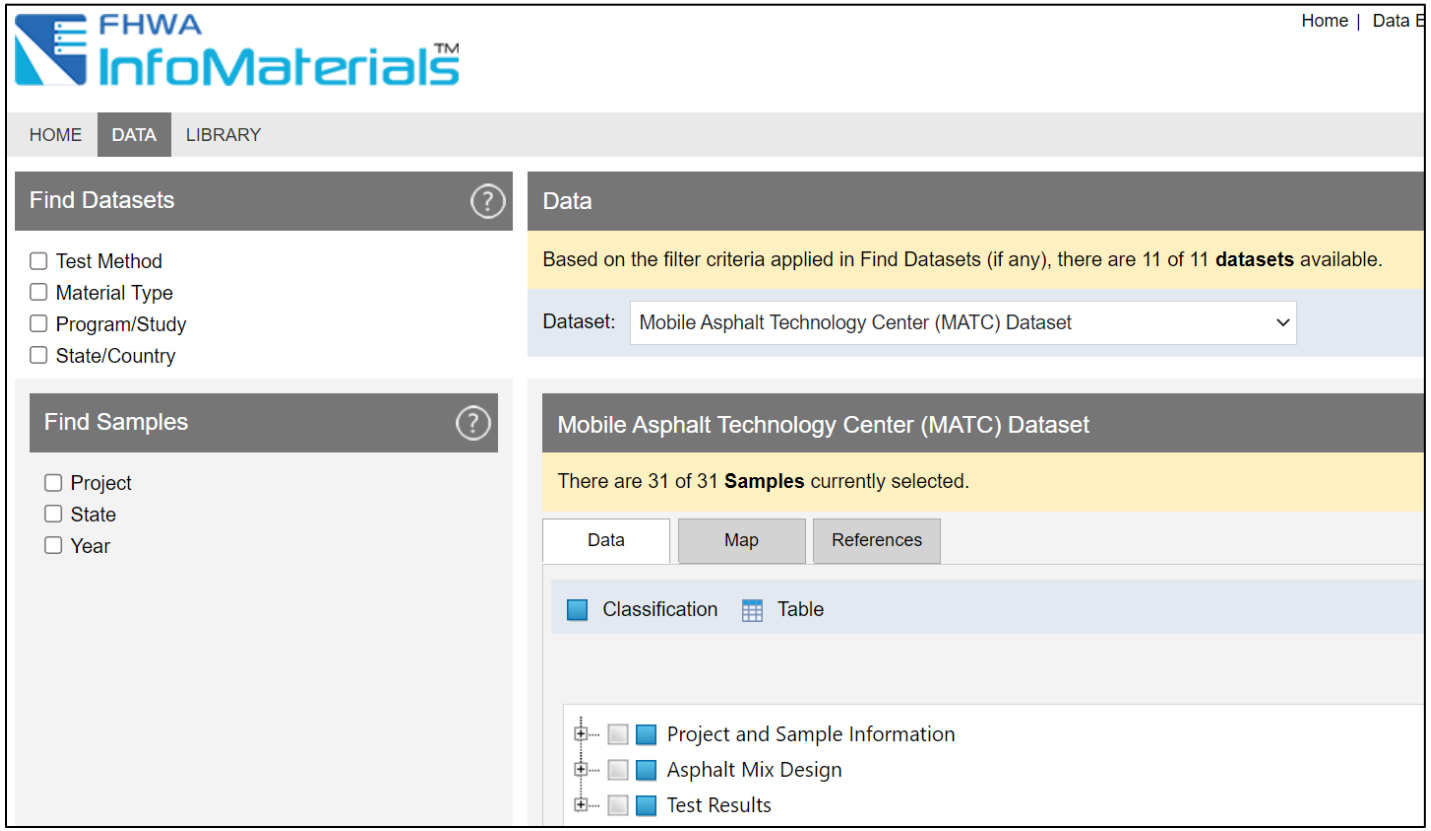
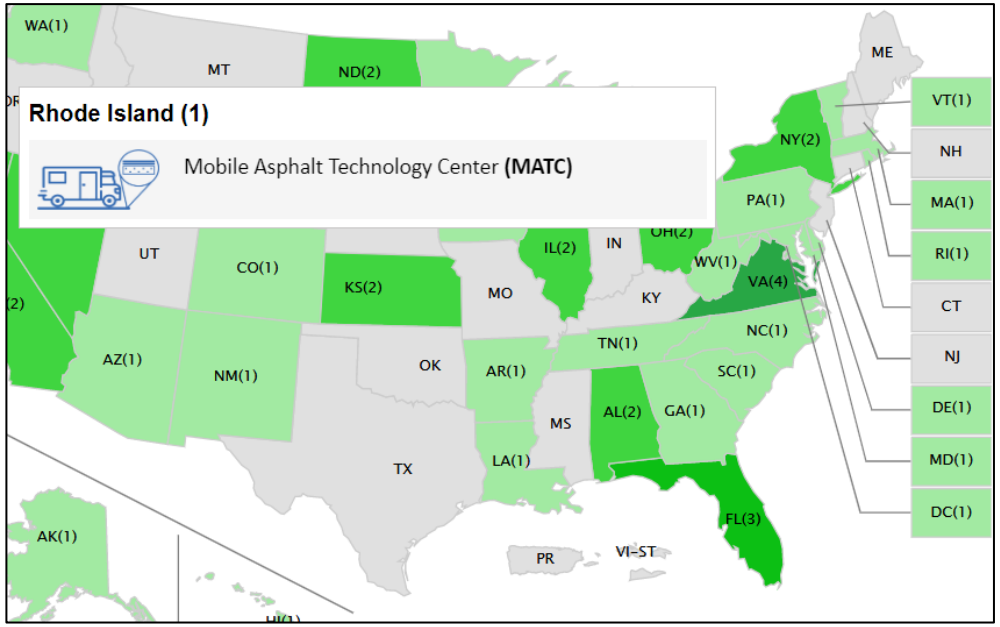
- Communication bursts to raise awareness on FHWA efforts
- Social Media
- Examples of Topics:
  - **Enhancing in-place density**
  - Spotlight on **Pavement Density**: Dielectric Profiling System Series
  - Spotlight on **Constructability**: Pave-IR Series
  - Spotlight on **Pavement Safety**: Macrotexture Series

[Technical Documents - Mobile Asphalt Technology Center - Asphalt - Pavement & Materials - Pavements - Federal Highway Administration (dot.gov)]

FHWA InfoMaterials: MATC Data from Past Site Visits

https://infomaterials.fhwa.dot.gov/Dataset/DatasetDetails



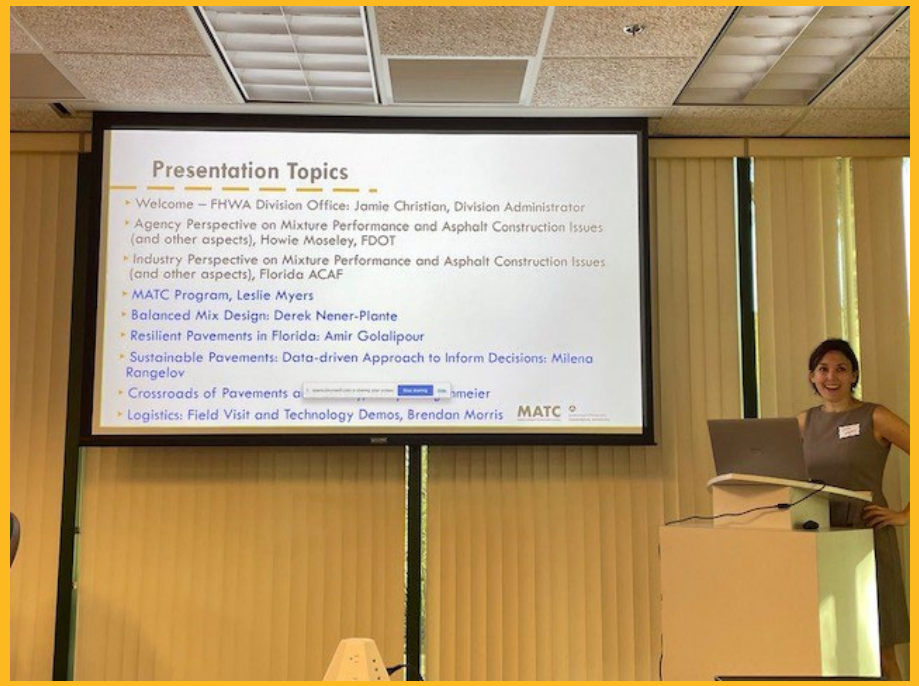


MATC "Lunch-n-Learn: Asphalt" Series

Pick topics for 1-hr virtual training

- ✓**Sustainability**
- ✓**Resilience**
- ✓Balanced Mix Design Implementation Tasks
- ✓Lab Look In: Live Training for 2-3 BMD Tests from the MATC
- ✓Responsible Use of RAP and RAS in Asphalt Mixtures
- ✓Ways to **Strengthen** Your Asphalt Quality Assurance Program
  - ✓Acceptance by the Agency
  - ✓Quality Control by the Contractor
- ✓Pavement Friction and Macrotexture for Pavement Safety
- ✓Others?

FHWA MATC *Quality in the Asphalt Paving Process Workshop*



- Two-day on-site workshop on asphalt materials and construction
- Includes State specific observations from field visit, specification review, and testing
- Scheduled within 6-9 months after site visit
- Agency and Industry participation (50/50)
- Goal: Actionable items

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FHWA MATC Asphalt 101 Live Seminar

- Free one-day seminar on asphalt materials, production, and construction fundamentals
- For anyone interested in broadening their basic knowledge of asphalt pavements
- Open to both State & Local Agencies as well as Industry Contractors, Producers, and Material Suppliers
- Offered during 4-week MATC site visit

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1-pagers & “Technician’s Tips and Tricks” videos

- Capabilities - Mobile Asphalt Technology Center - Asphalt - Pavement & Materials - Pavements - Federal Highway Administration (dot.gov)
- **Videos**
  - Hosting a Visit from the FHWA Mobile Asphalt Technology Center (MATC)
  - Indirect Tensile Cracking Test (IDEAL-CT)
  - Indirect Shear Rutting Test (IDEAL-RT)
- **MATC Motivating Innovation Around the Nation**
  - **North Dakota DOT**
  - **Vermont DOT**
- **Spotlight on Pavement Series**
  - **Density**
  - **Uniformity**
  - **Safety**

Agency Specification Review Recommendations on:

Best Practices

Quality Assurance roles

Acceptance limits

Equipment Loan Program

Equipment Loan Program

Request form submitted via FHWA P&M Engineer in Division Office

- DPS unit
- Pave-IR unit
- Circular track meter
- Laser texture scanner
- SmartJig for IDEAL-RT and IDEAL-CT tests
- Handheld XRF binder device
    - Limestone, titanium dioxide, REOB

Equipment loan includes on-site training by MATC or consultant, final Lessons Learned document, and post-loan briefing presentation

U.S. Department of Transportation
Federal Highway Administration

MATC
MOBILE ASPHALT TECHNOLOGY CENTER

EQUIPMENT LOAN PROGRAM

In order to increase the likelihood of adoption of new technologies, the FHWA's Mobile Asphalt Technology Center (MATC) provides loans of laboratory and field equipment to the asphalt pavement community.

Why borrow from FHWA? Providing the opportunity for members of the asphalt paving community to trial technologies and test procedures can significantly increase the likelihood of adoption. By borrowing equipment, agencies and contractors don't have to front the resources to buy an expensive piece of equipment, only to potentially find that it may not meet their needs.

The standard equipment loan duration is limited to 2 months. Depending on both the need and current equipment availability, loan durations can often be extended upon request.

EQUIPMENT AVAILABLE FOR LOAN

- Paver-Mounted Thermal Profiler (PMTP) for mat temperature
- Pulse Induction Technology for mat thickness
- Dielectric Profiling System (DPS) for mat and joint density and DPS Calibration Kit
- Circular Track Meter (CTM) and Laser Texture Scanner (LTS) for surface macrotexture
- Jig sets for balanced mixture design testing for cracking potential (IDEAL-RT, I-FIT, or OT)
- SmartJig device (with software) for balanced mixture design cracking and rutting potential (IDEAL-CT and IDEAL-RT)
- X-Ray Fluorescence Spectrometer (XRF) for determining the elemental composition of asphalt binders
- Automatic Vacuum Sealing Device for specific gravity testing

43

Summary

Mission
Site Visits
Demo Technologies
Information Outreach
Lunch and Learn
Specification Review
Equipment Loan Program

MATC
MOBILE ASPHALT TECHNOLOGY CENTER

Thank You
Questions?

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https://www.fhwa.dot.gov/matc

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