



U.S. Department of Transportation
Federal Highway Administration

FHWA Mobile Asphalt Technology Center: Recent Work in the Northeast

NESMEA 2023

October 24, 2023



Acronyms

- ▶ ABML-ID: Asphalt binder and mixture laboratory – implementation and delivery
- ▶ ABT: Asphalt Binder Tester
- ▶ BMD: Balanced mix design
- ▶ NHDOT: New Hampshire Department of Transportation
- ▶ CT_{index} : Cracking index
- ▶ E^* : Dynamic modulus
- ▶ FHWA: Federal Highway Administration
- ▶ FI: Flexibility Index
- ▶ FTIR: Fourier transform infrared spectroscopy
- ▶ HWT: Hamburg wheel tracker
- ▶ I-FIT: Illinois Flexibility Index Test
- ▶ MaineDOT: Maine Department of Transportation
- ▶ MATC: Mobile Asphalt Technology Center
- ▶ mm: millimeter
- ▶ N_{des} : Design gyrations
- ▶ NRRI: Normalized rutting resistance index
- ▶ PG: Performance grade
- ▶ QA: Quality assurance
- ▶ RQL: Rejectable quality limit
- ▶ RSI: stress sweep rutting index
- ▶ S_{app} : cyclic fatigue index parameter
- ▶ SIP: Stripping inflection point
- ▶ TFHRC: Turner-Fairbanks Highway Research Center
- ▶ VBE: Voids filled with effective binder
- ▶ VMA: Voids in the mineral aggregate
- ▶ VTrans: Vermont Agency of Transportation

Outline

- ▶ MATC Overview & Mission
- ▶ Ongoing MATC Support to Northeast
 - New Hampshire DOT
 - Connecticut DOT
- ▶ What can we do for you?



Mobile Asphalt Technology Center

- ▶ MATC is on the move to serve the asphalt pavement community!



MATC Mission:

Our mission is to introduce new and emerging asphalt materials and construction technologies to States and industry, which bridges the gap between research and implementation.

MATC Goal:

These technologies and practices are implemented by agencies and industry to provide longer-lasting, safer, better-performing, and more cost-effective asphalt pavements on our nation's highways.

FHWA Asphalt Technology Deployment

- ▶ **Project Site Visits:** provide agencies and industry with first-hand exposure to new technologies (currently, 8 mixture tests, 4 materials tests, and 5 field tests)
- ▶ **Customized Training Workshops:** classroom and online training based on field test results and observations
- ▶ **Equipment Loan Program:** gain hands-on experience before making a resource commitment
- ▶ **Technical Guidance:** based on identified national trends to encourage agencies and industry to evaluate and improve their specifications and practices

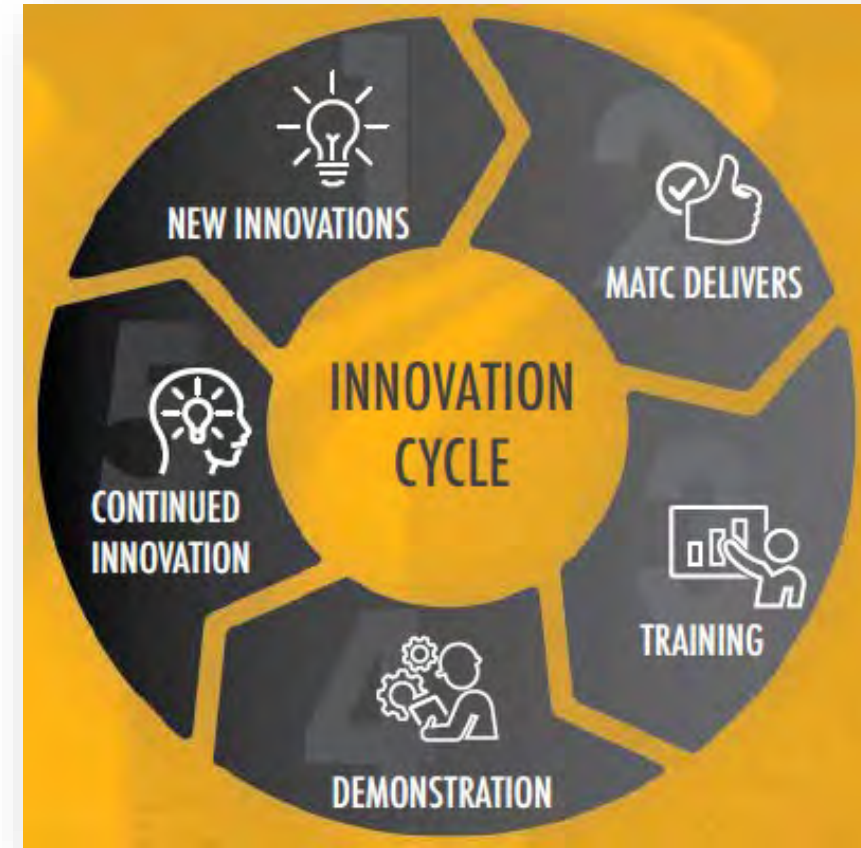


Image Source: FHWA

Technologies Offered by FHWA MATC

Mixture

- ▶ AMPT suite of tests (cyclic fatigue, E*)
- ▶ Overlay test for reflective cracking
- ▶ Flexibility index test (I-FIT) for fracture resistance
- ▶ ITC (IDEAL-CT) for crack resistance
- ▶ IDEAL-RT for rutting resistance
- ▶ Hamburg wheel tracker

Materials

- ▶ X-Ray Fluorescence (XRF) Spectrometer
- ▶ ABT (true grade binder)
- ▶ FTIR for binder molecular analysis



Field

- ▶ Paver-mounted thermal profiler (PMTP)
- ▶ Pulse induction technology for in-place pavement thickness
- ▶ Pavement macrotexture measurements (3 methods)
- ▶ Dielectric profiling systems (DPS)

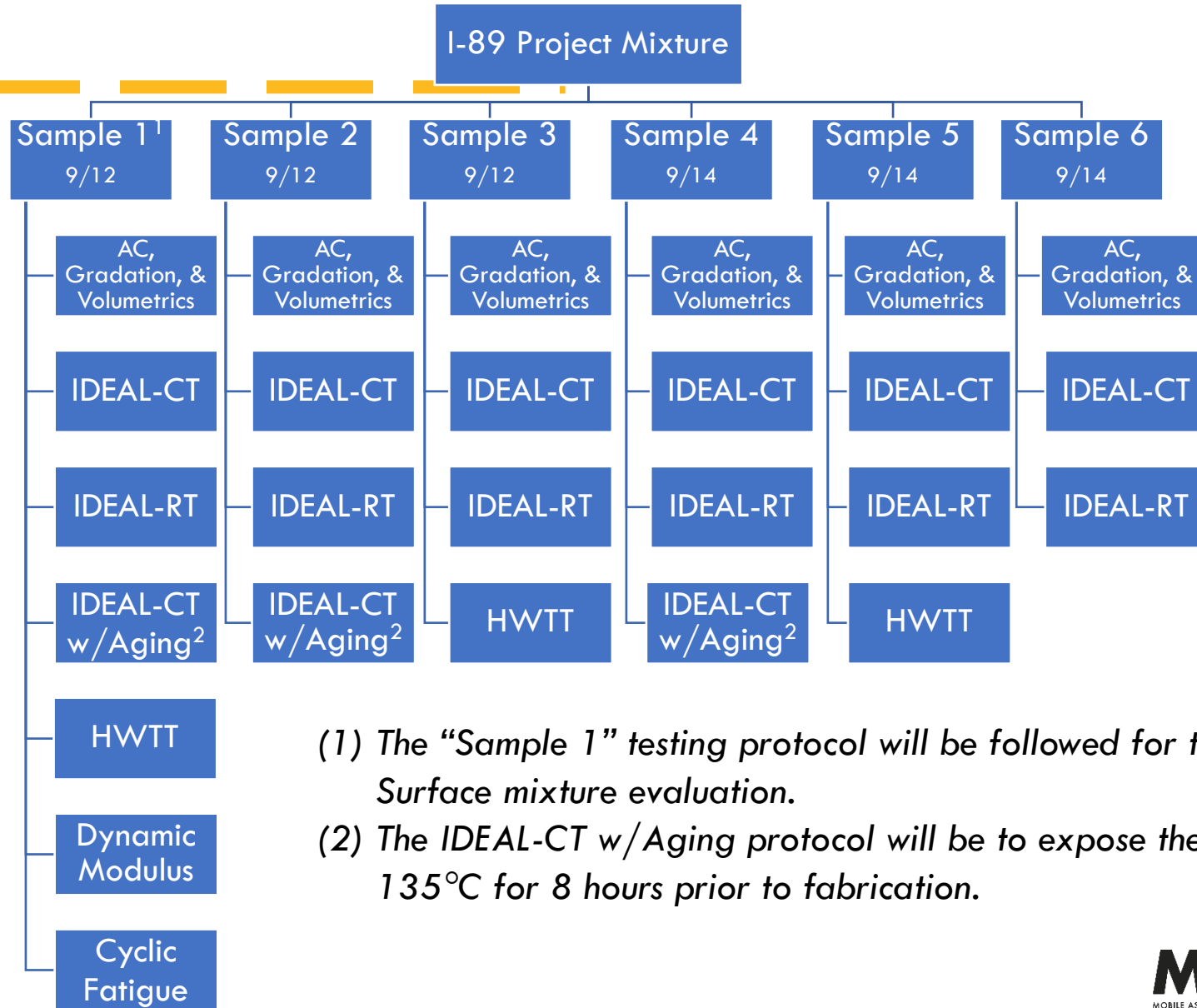
New Hampshire DOT Site Visit

NH Project Background

- ▶ MATC setup at 150 New Hampshire Route 103, Warner, NH 03278
- ▶ Mixture/Asphalt Binder sampling and testing from test project as per test plan
 - I-89 “Winter Binder” mixture
- ▶ Field Testing Demonstrations



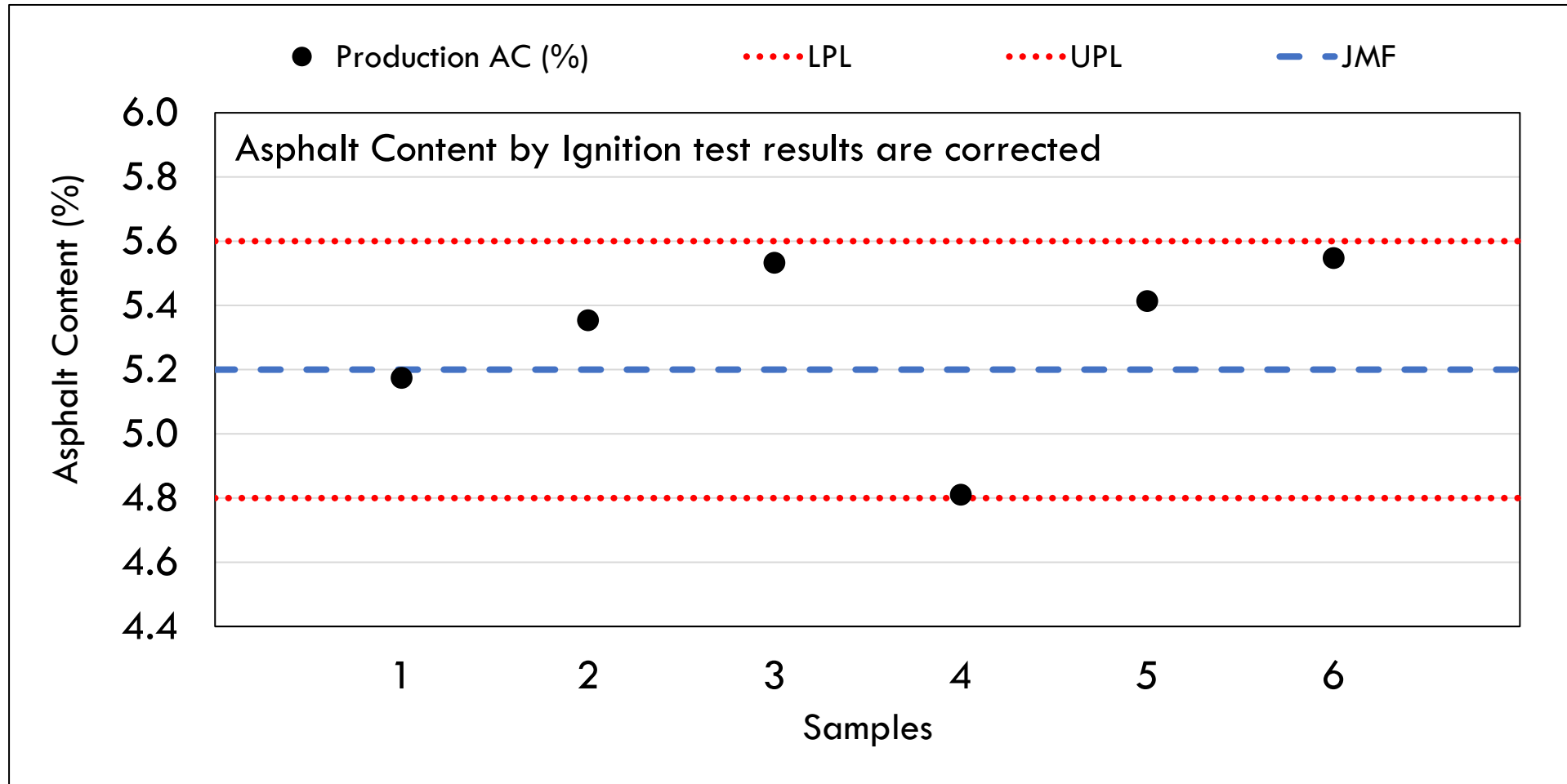
Mixture Testing Plan for I-89 Project



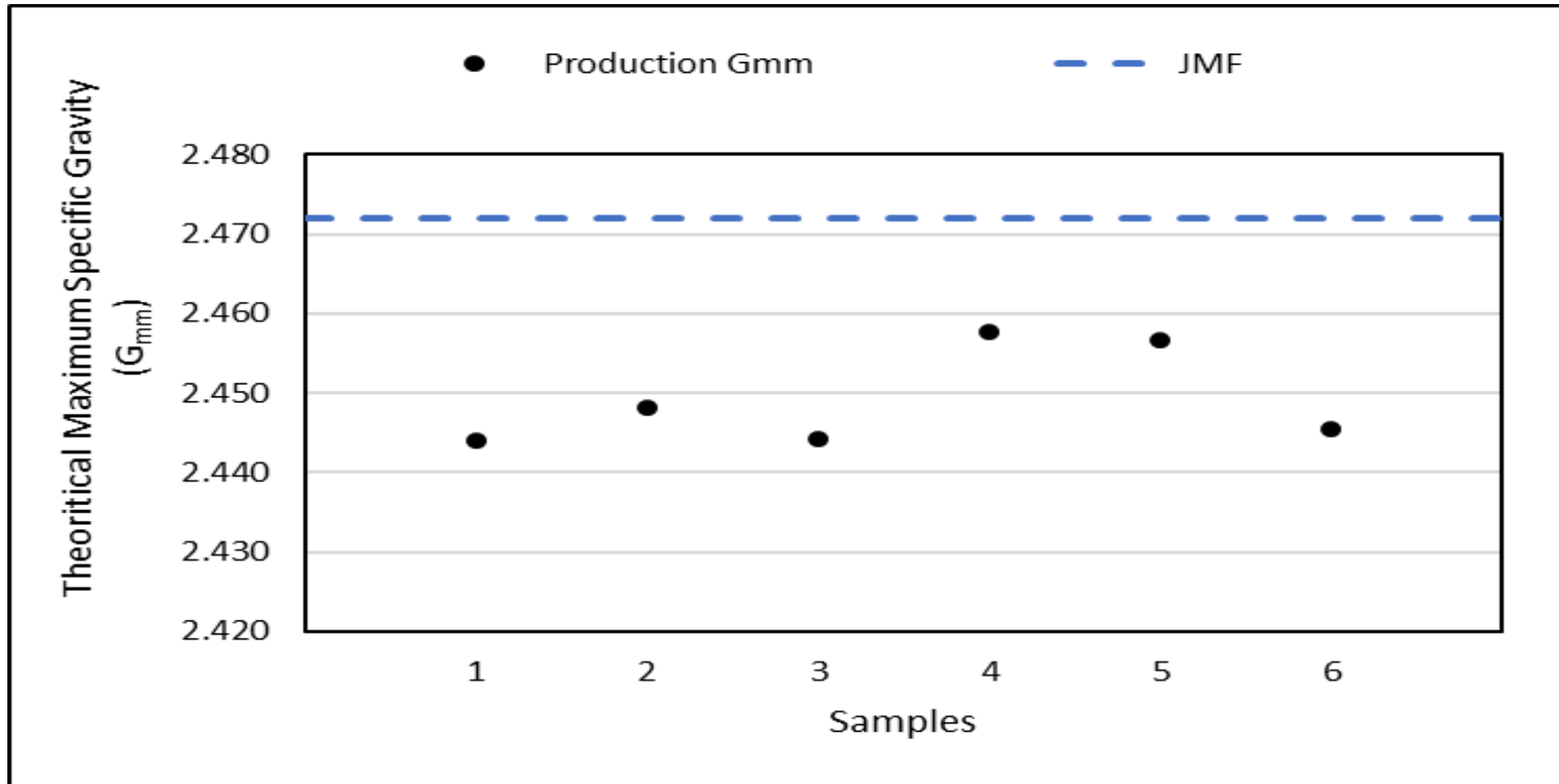
- (1) The “Sample 1” testing protocol will be followed for the one sample I-93 Surface mixture evaluation.
- (2) The IDEAL-CT w/Aging protocol will be to expose the loose mixture to 135°C for 8 hours prior to fabrication.

Volumetrics (*Production Samples*)

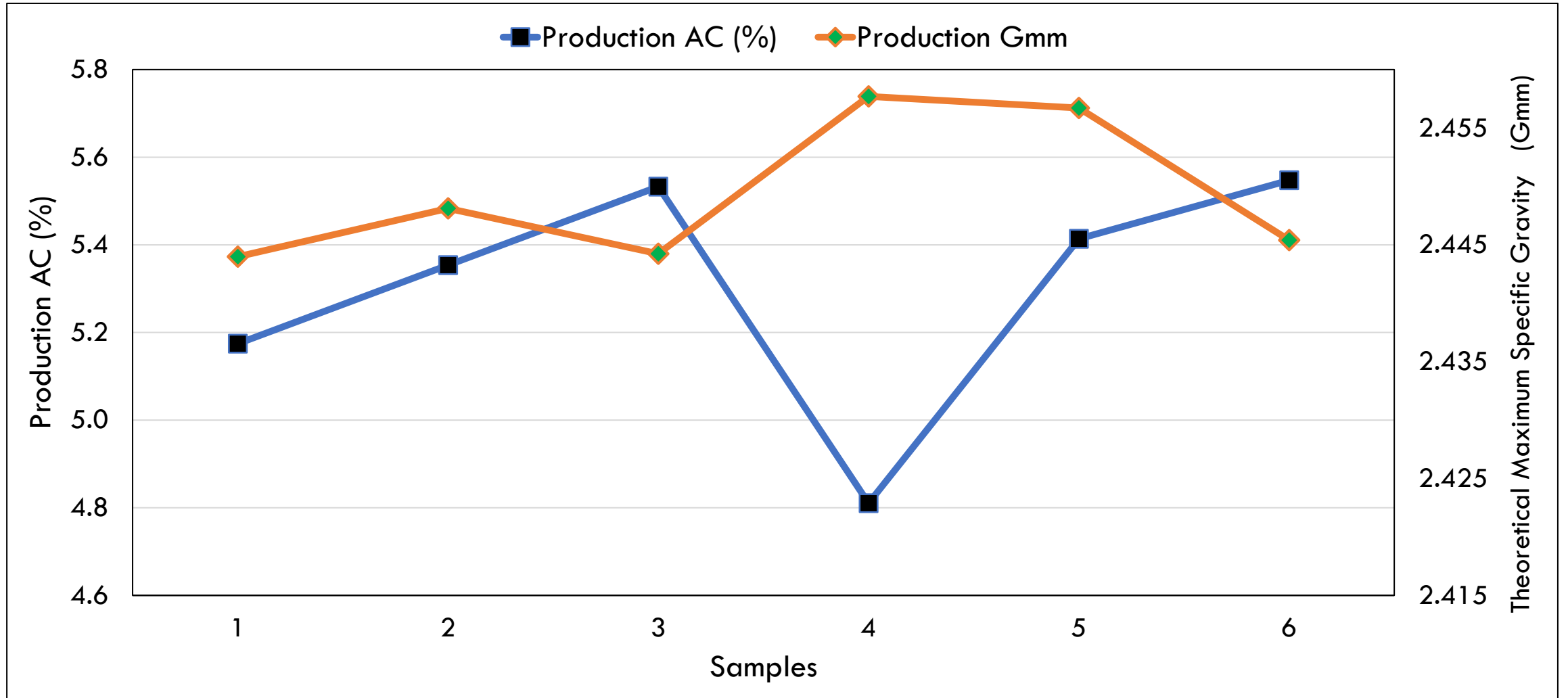
Asphalt Content (%)



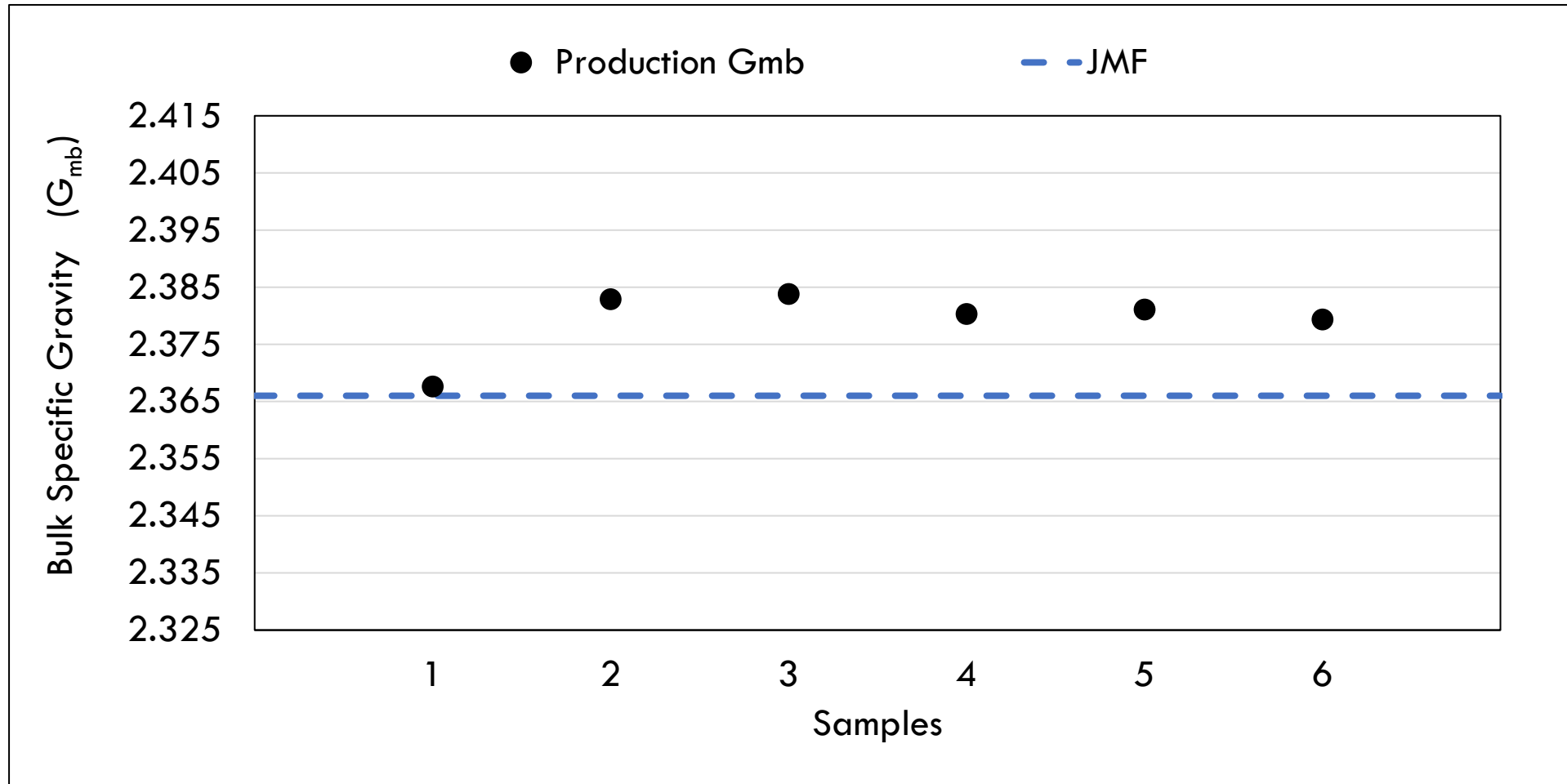
Maximum Specific Gravity (G_{mm})



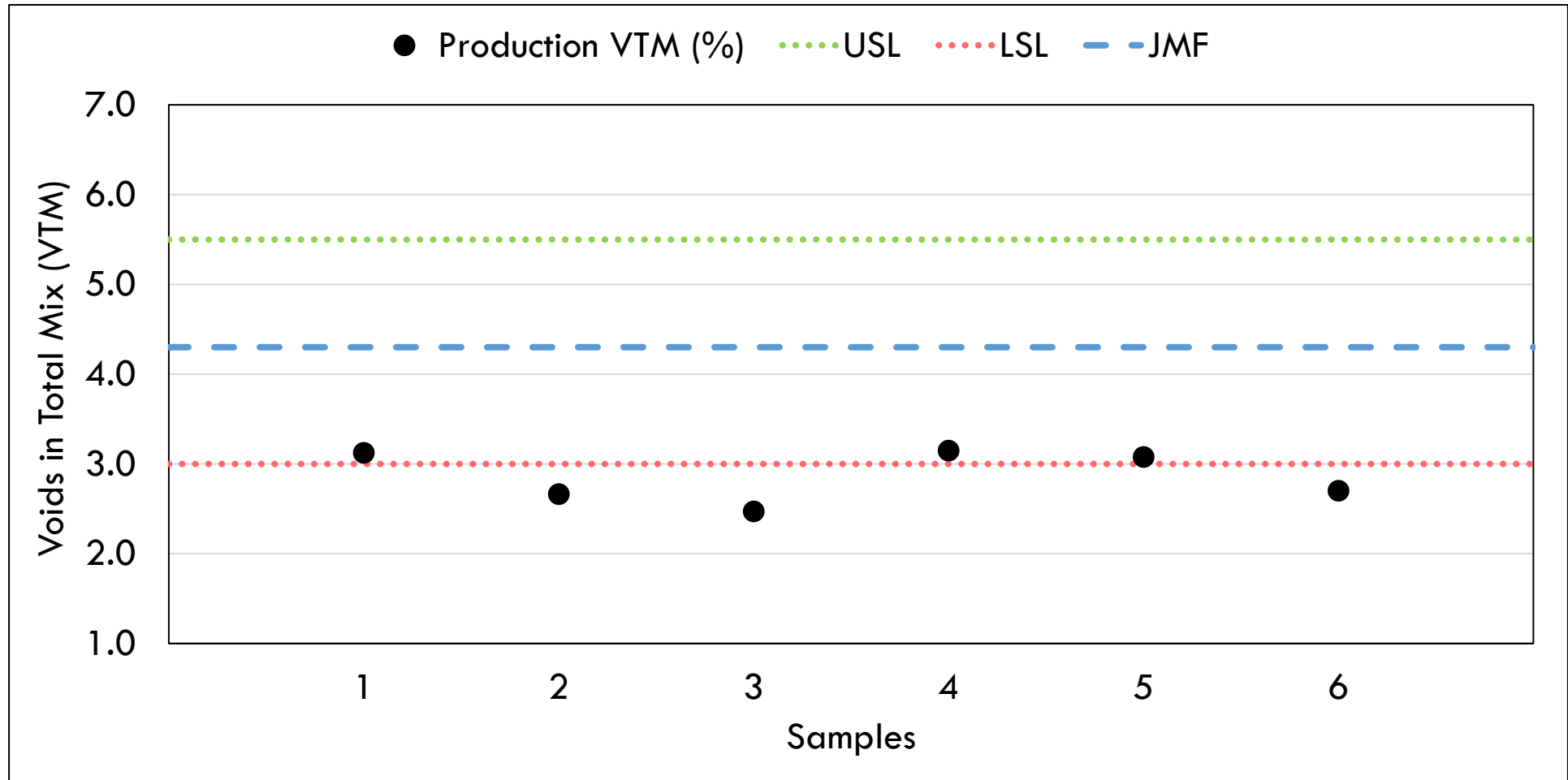
Production AC (%) vs G_{mm}



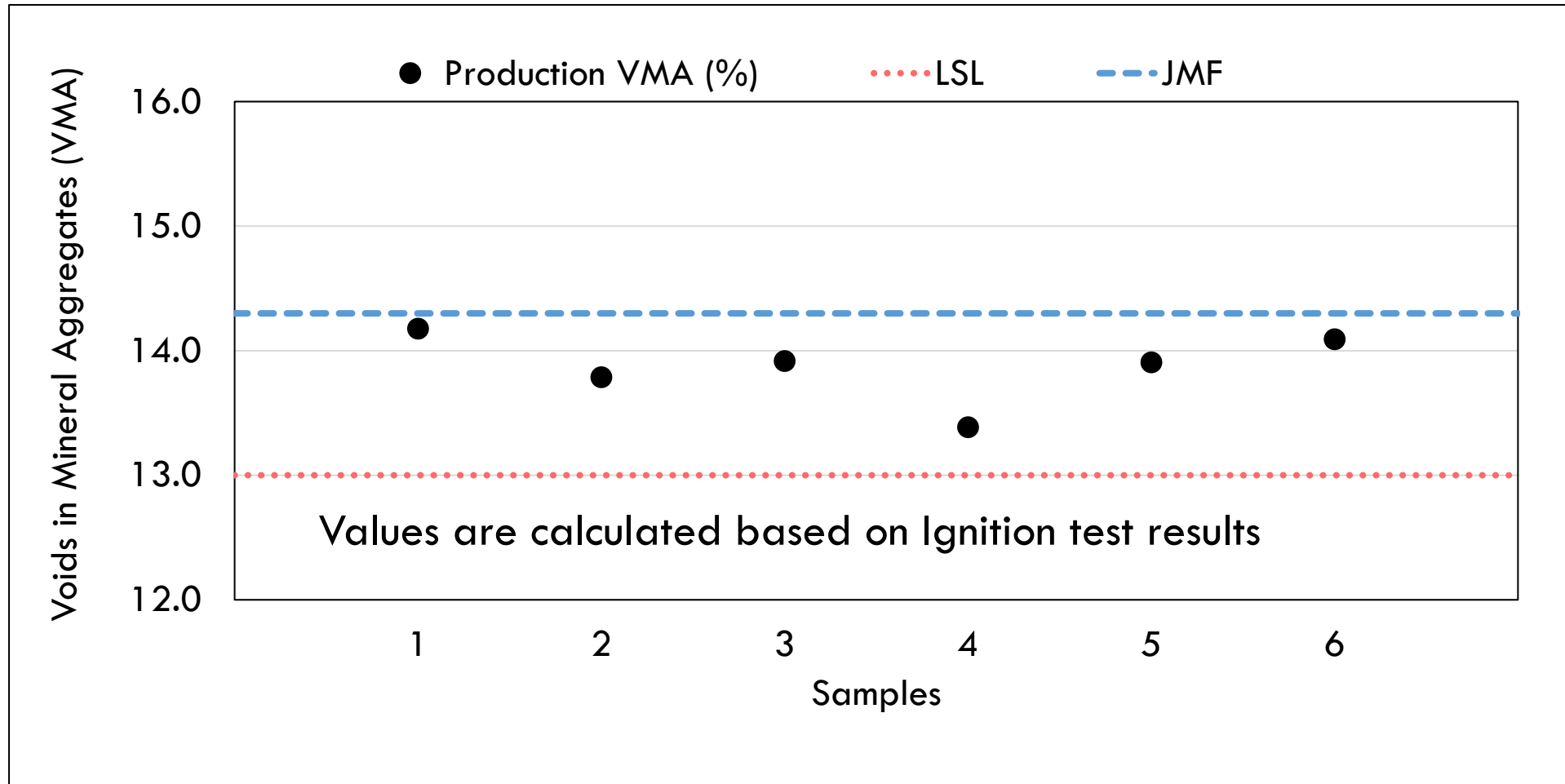
Bulk Specific Gravity (G_{mb})



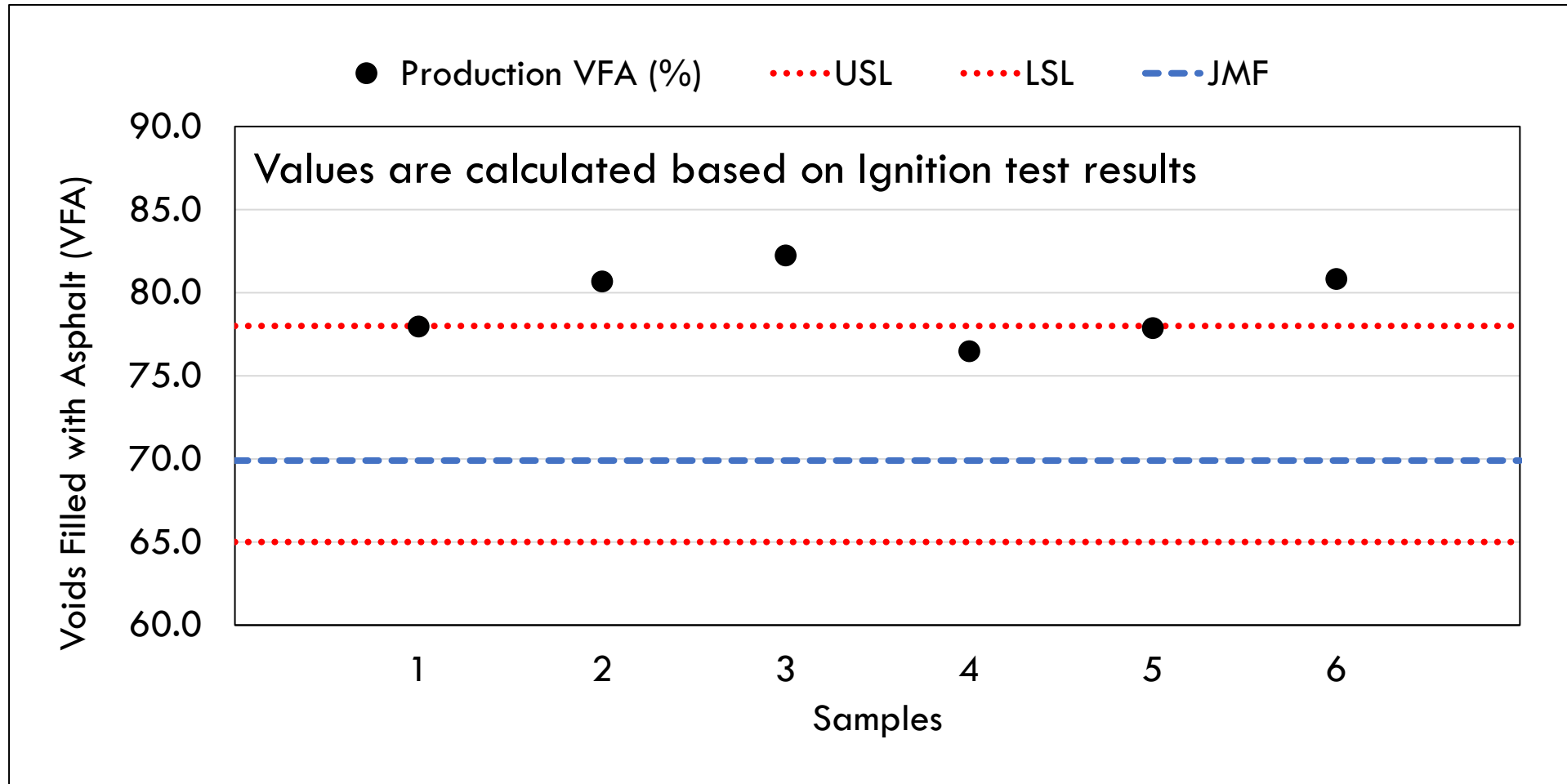
Voids in Total Mix (VTM)



Voids in Mineral Aggregates (VMA)

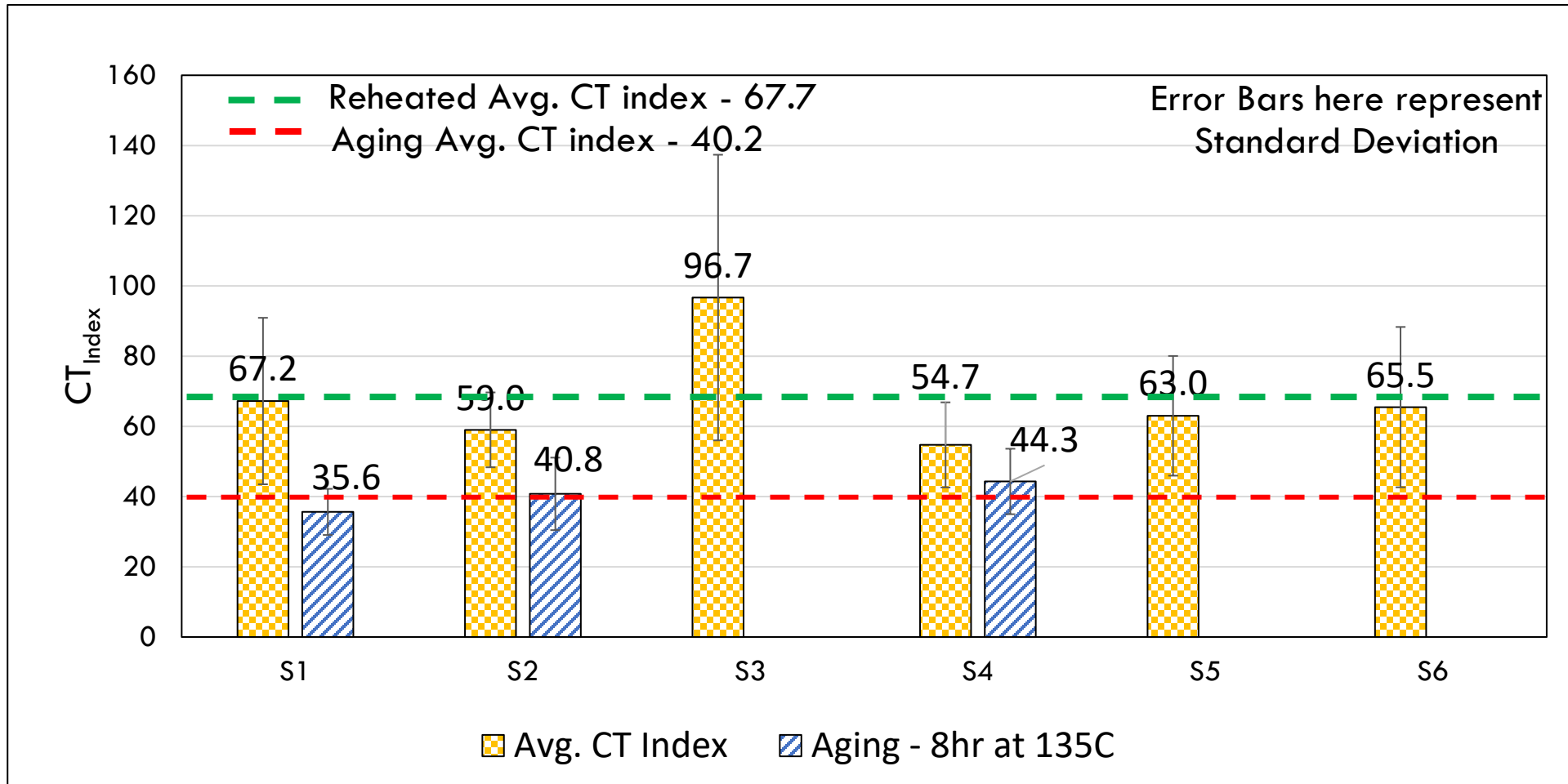


Voids Filled with Asphalt (VFA)

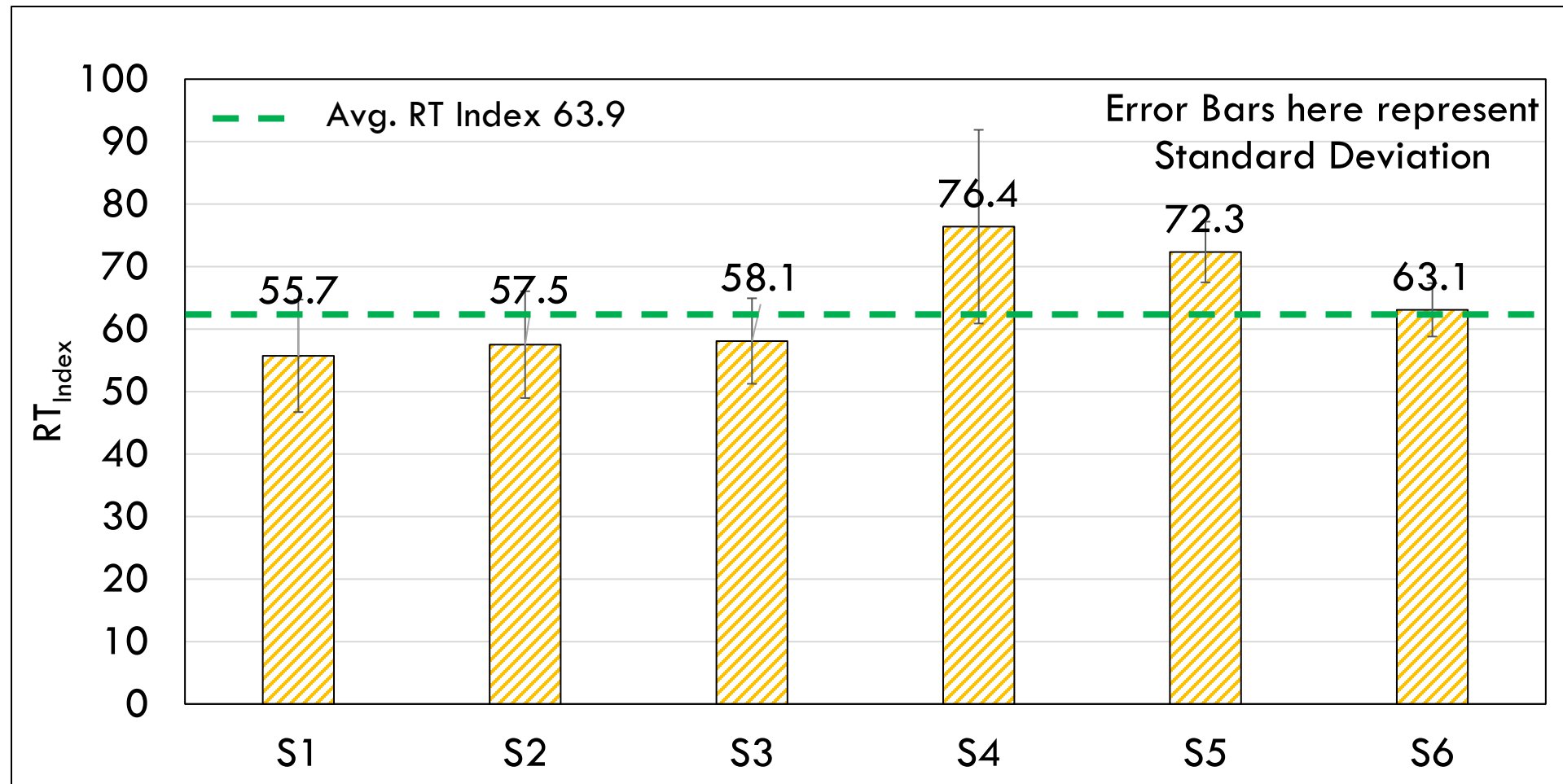


BMD Testing

IDEAL-CT Results



IDEAL-RT Results



Asphalt Binder Testing

X-Ray Fluorescence (XRF)

- ▶ Determines the Elemental Composition of Materials
- ▶ Potential Use
 - Detection of Recycled Engine Oil Bottoms (REOB), lime, and polyphosphoric acid (PPA) in asphalt
 - QC/QA of traffic paints and epoxies
 - Analysis of heavy metals in construction debris, aggregates, soils etc.



FHWA TechBrief: FHWA-HRT-18-043

Elements	REOB
Phosphorus	1.5-1.9%
Sulfur	1.5-1.9%
Calcium	7,200–10,900 ppm
Iron	370–1,800 ppm
Copper	700–1,500 ppm
Zinc	4,500–7,200 ppm
Molybdenum	300–700 ppm

X-Ray Fluorescence (XRF)

Sample ID	Calcium (ppm)	Molybdenum (ppm)	Zinc (ppm)	Copper (ppm)
NH23127-Sample1 (PG64-28)	229	56	<LOD	<LOD
NH23127-Sample2 (PG64-28)	234	63	<LOD	<LOD
NH23127-Sample3 (PG64-28)	233	36	<LOD	<LOD
Average	232	52	<LOD	<LOD
REOB (%)	~0			

Field Testing Demonstrations

Paver-Mounted Thermal Profiler

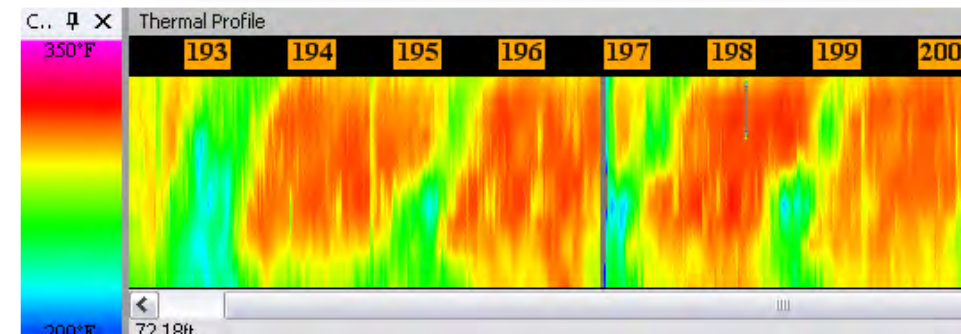
Ready to Use

Technology

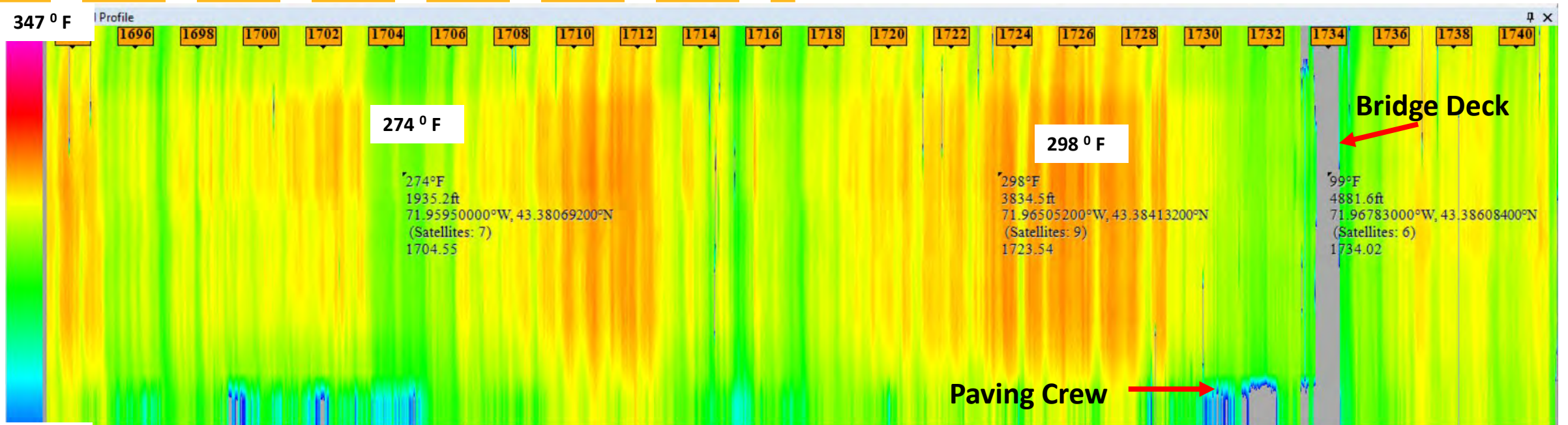
- ▶ High precision real time thermal profiler to detect pavement mat defects before compaction
- ▶ Used for identifying segregation and low-density issues
- ▶ Infrared sensors for measuring temperature uniformity of new asphalt surfaces
- ▶ Thermal profile imaging of mat surface done at 2 to 3 meters behind screed



Images: SHRP2 (R06 C)

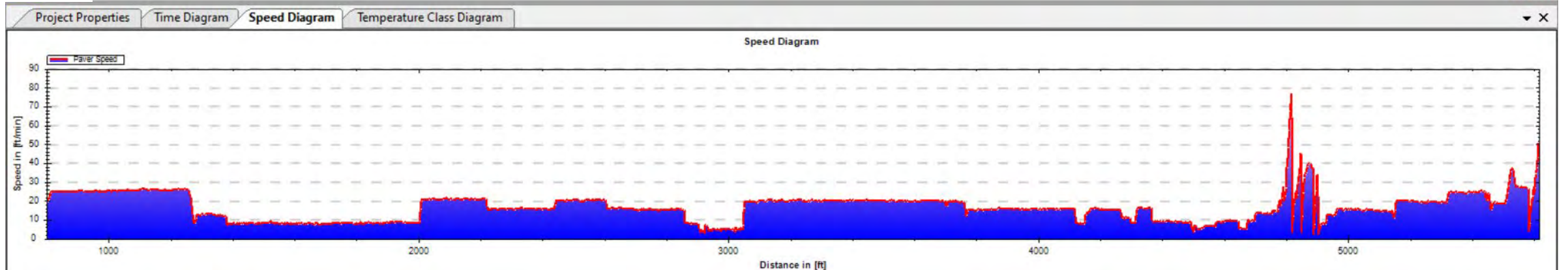


Paver-Mounted Thermal Profiler

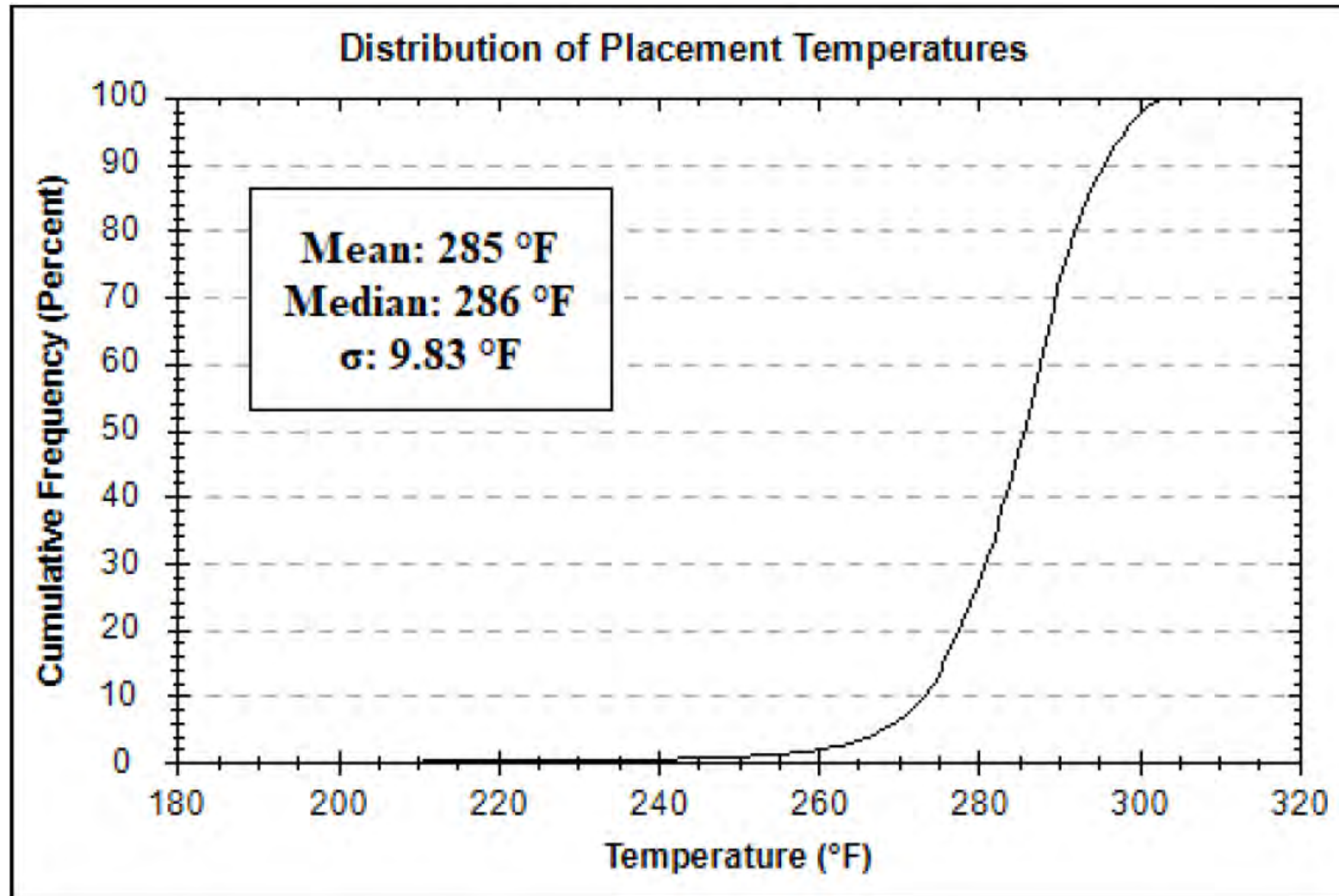


203 °F

5615.57ft



Paver-Mounted Thermal Profiler

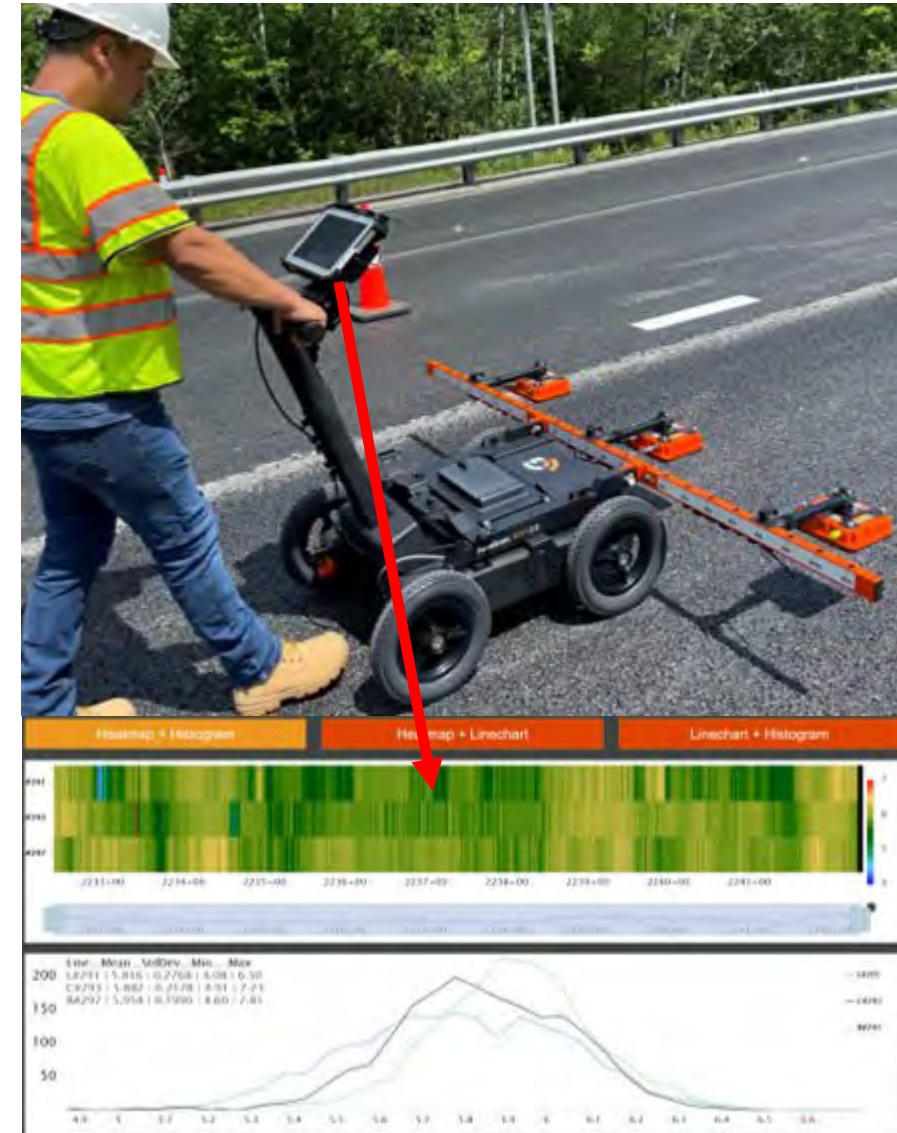


Dielectric Profiling System (DPS)

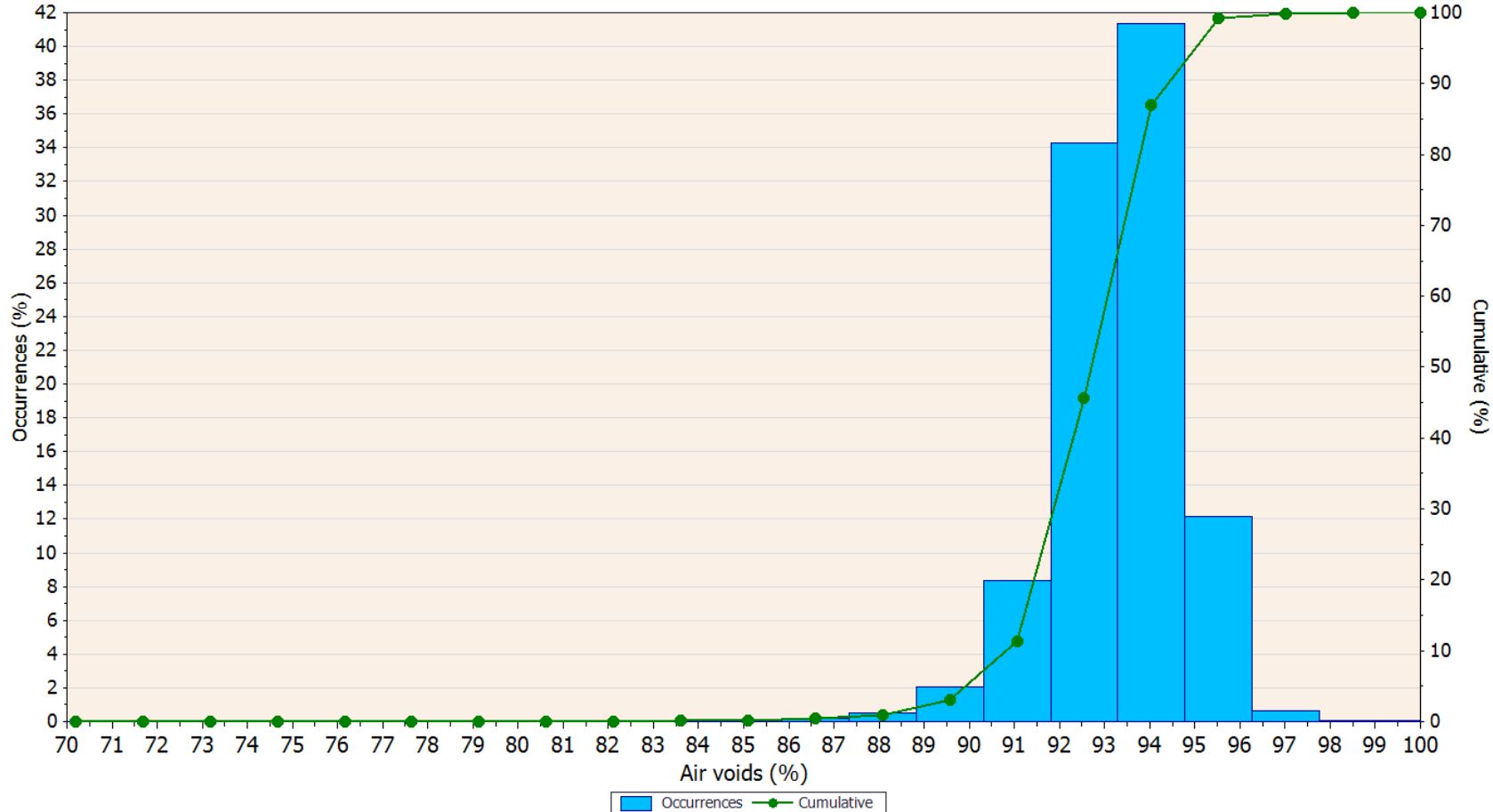
Emerging

Technology

- ▶ Uses ground penetrating radar technology to measure density.
- ▶ Unlike coring, DPS provides continuous measurements, resulting in nearly 100% coverage of the constructed layers.
 - Field cores and lab compacted specimens are still needed to calibrate the measured dielectric constant to the actual pavement density
- ▶ Potential for complete enumeration of the pavement density.

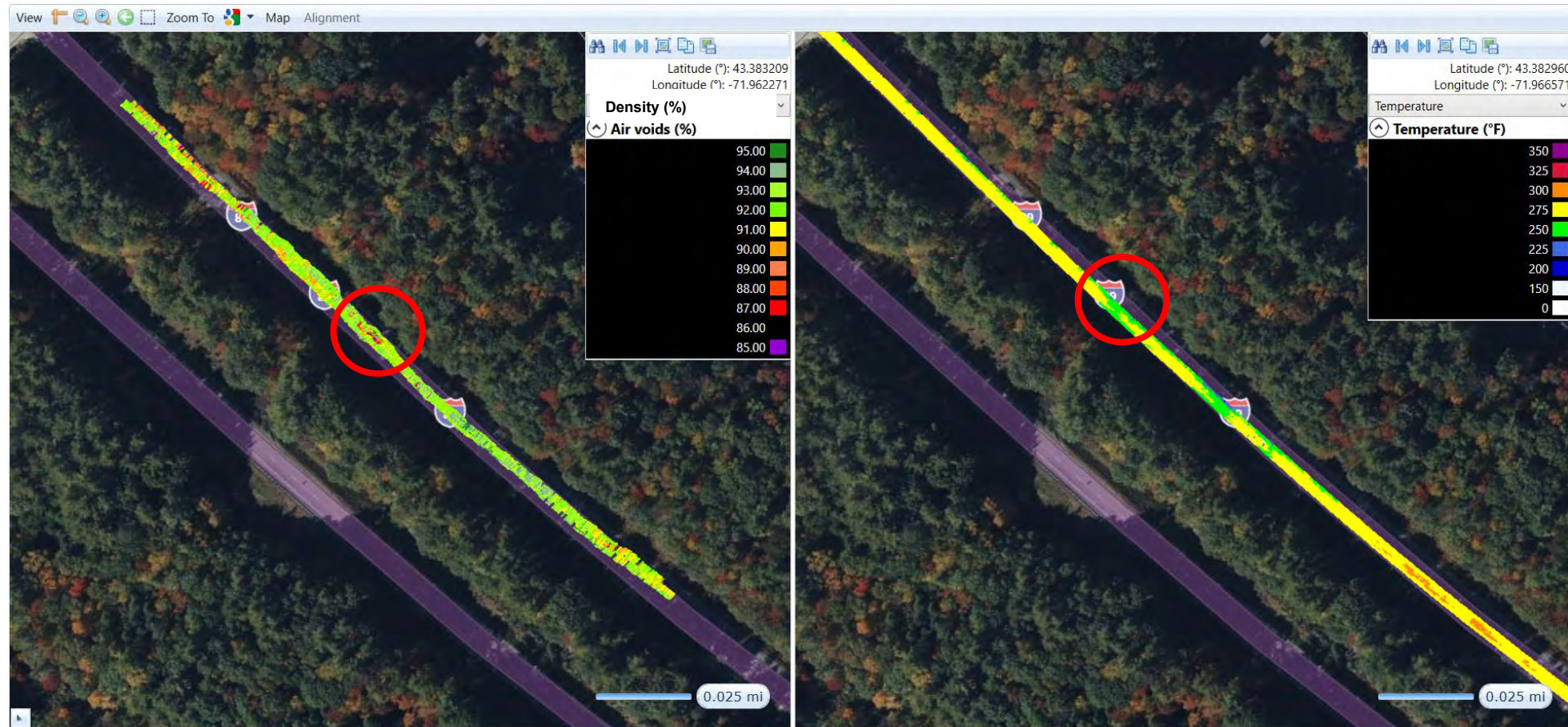


Dielectric Profiling System (DPS)



Statistic	Value
Mean	92.6
Standard Deviation	1.5
Min	70.2
Max	99
Sample Size	12,075

Dielectric Profiling System (DPS) - VETA



Pulse Induction Technology

- ▶ Nondestructive device to measure pavement thickness on either asphalt or concrete pavements
- ▶ Eliminates the need for taking cores
- ▶ Pulse Induction device requires preplacing a thin metal 'target' (plate) on the base before paving
- ▶ Distance between the plate and surface of the pavement is measured

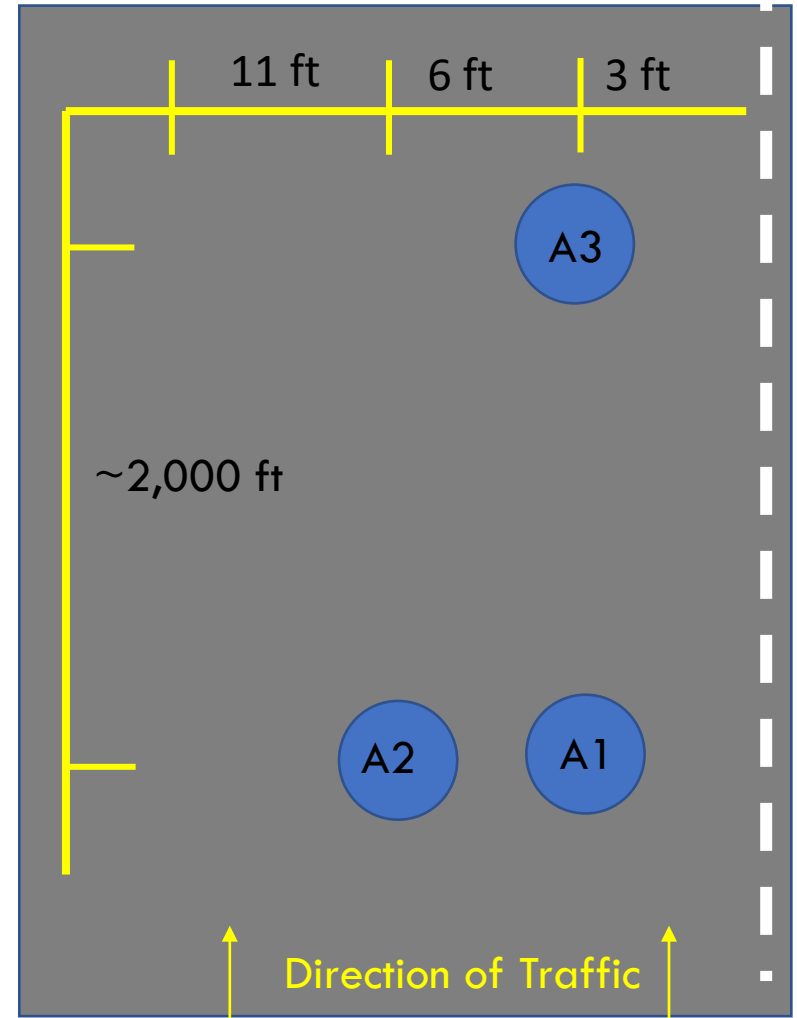
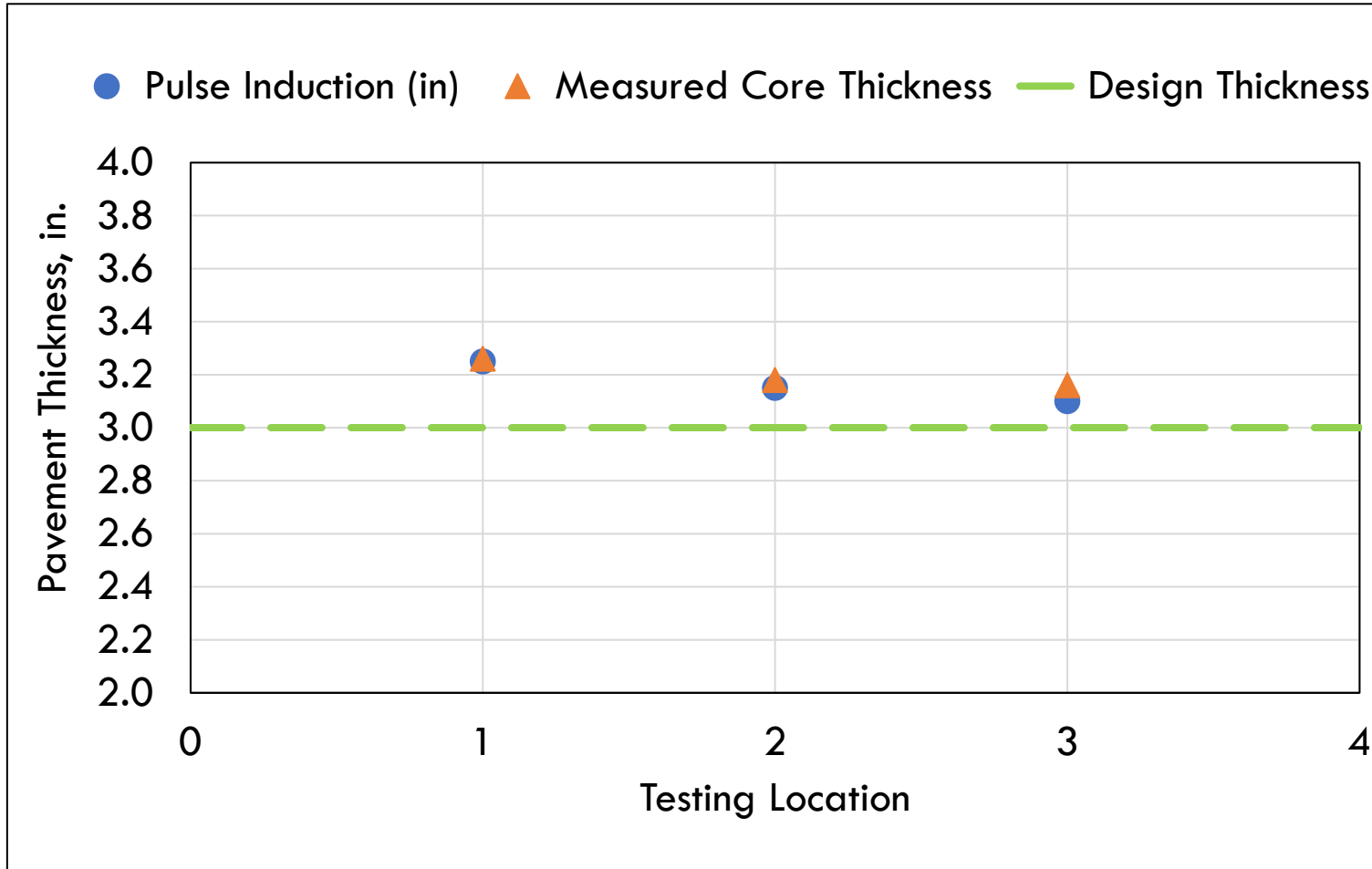
Ready to Use

Technology



Pulse Induction Technology

GPS - 43°22'53.5"N, 71°57'39.8"W
Location - Interstate 89 N, Warner, NH



Emerging

Technology

Laser Texture Scanner (LTS)

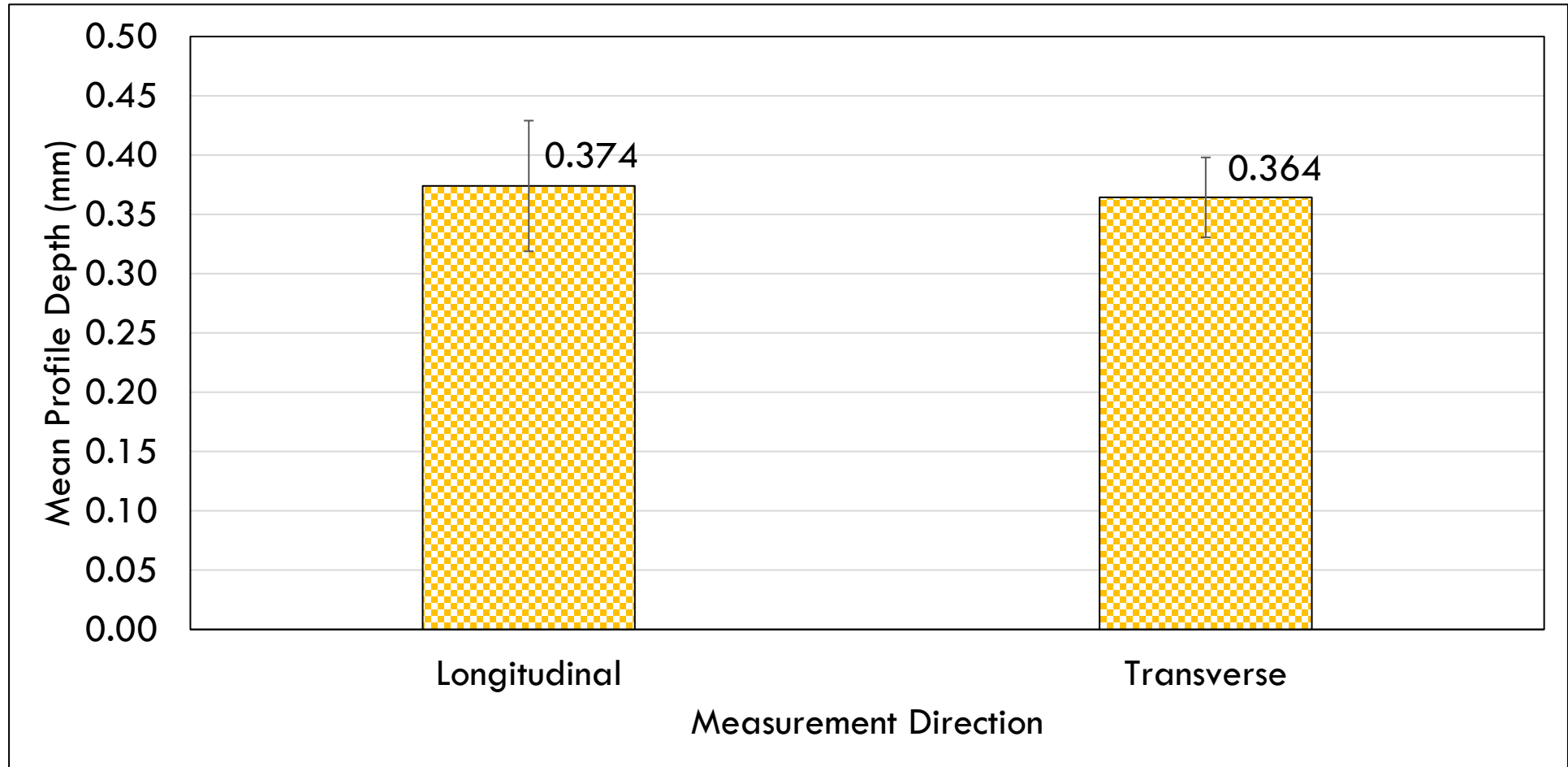
- ▶ Portable 3D Laser Texture Scanner
 - Rapid Measurements – within 90 seconds
 - 100 mm x 100 mm scan area
 - Laboratory and field applications
 - Mean Profile Depth (MPD)
- ▶ Materials
 - In-place (project site)
 - Field cores (project site)
 - Gyrotory specimens (laboratory)
- ▶ Obtain six 6-inch cores from random locations for laboratory testing comparison against lab compacted specimens



Source: FHWA



Laser Texture Scanner (LTS)



Dense-graded HMA – MPD Typically ranges from 0.4 to 0.8 mm according to 2022 AASHTO Guide for Pavement Friction

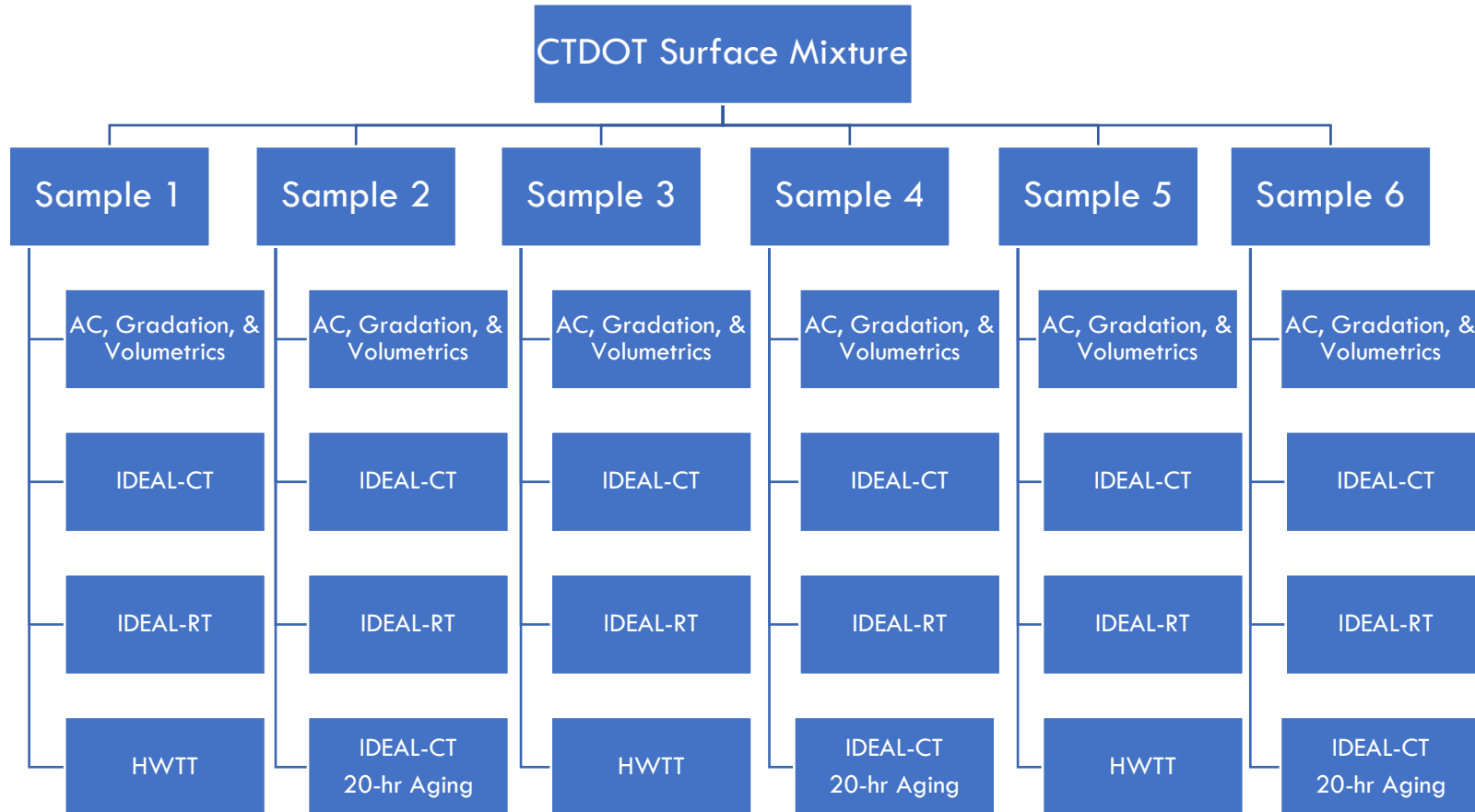
Connecticut DOT Site Visit

CT Project Background

- ▶ MATC setup at CTDOT Materials in Rocky Hill, CT
- ▶ Mixture/Asphalt Binder sampling and testing from test project as per test plan
 - Route 222 in Thomaston, CT
 - 1/2" Superpave 75 gyration w/ 64S-22.
- ▶ Field Testing Demonstrations



Mixture Testing Plan for Route 222 Project





U.S. Department of Transportation
Federal Highway Administration

MATC
MOBILE ASPHALT TECHNOLOGY CENTER

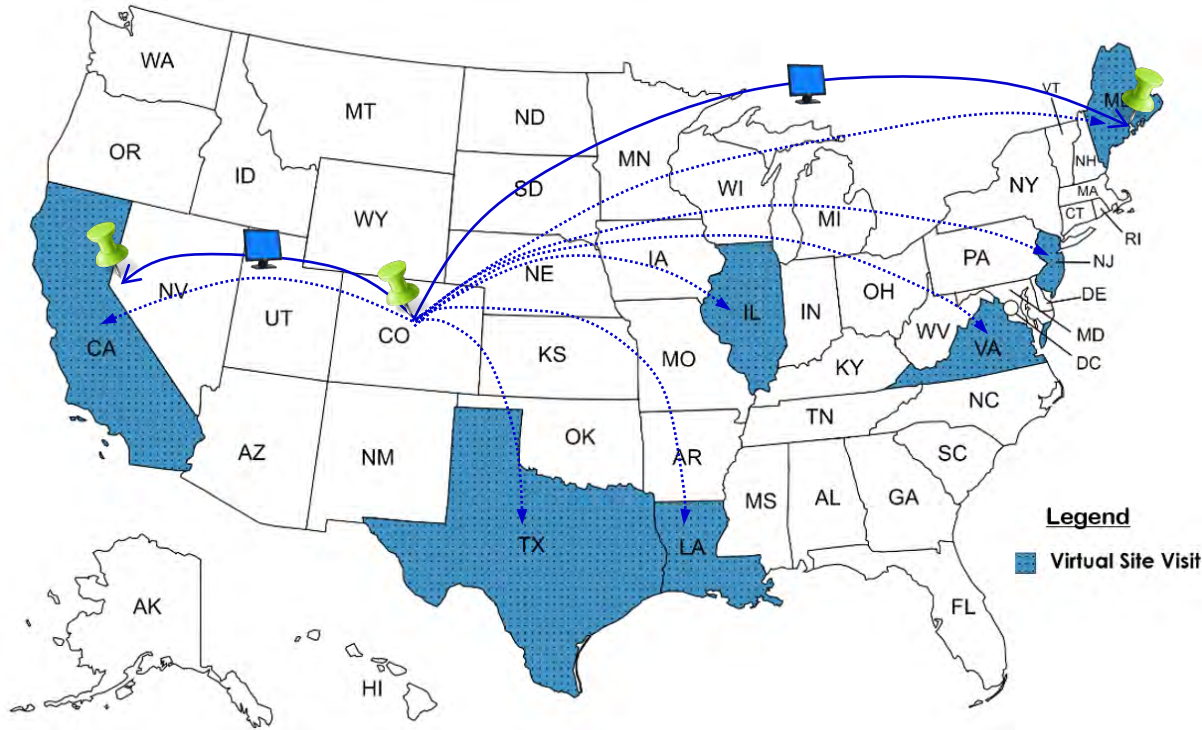
What can FHWA MATC do for you?

Unless otherwise noted, FHWA is the source for all images in this presentation.

Source: Getty Images

Workshops

FHWA BMD Case Studies Virtual Workshop



U.S. Department of Transportation
 Federal Highway Administration

Federal Highway Administration
RESOURCE CENTER

Balanced Mix Design (BMD) Case Studies Virtual Workshop: Moving Forward with Implementation



Description

This free Federal Highway Administration (FHWA) workshop will provide State DOTs with knowledge on how to get started and/or move forward with the implementation of BMD as learned from in-depth case studies of key State DOTs. It is **customized** to a State DOTs current situation with its BMD implementation program. This unique workshop includes providing managers and practitioners with knowledge on:

- a. the overall BMD process and its benefits;
- b. the planning and activities needed for the selection, evaluation, and implementation of performance tests for routine uses in a BMD process; and
- c. positive practices and lessons learned by key State DOTs.

The workshop will focus on a BMD implementation process that was developed and conducted from in-depth case studies of key State DOTs.

Location

The free virtual workshop will be delivered using Microsoft Teams or any other virtual meeting platform accepted by a State Department of Transportation (DOT).

Length

The workshop is a total of six hours and will include multiple segments with a maximum of three hours per segment. The workshop can be delivered over the course of several days.

Target Audience

The successful implementation of BMD will need to be a team effort. Thus, the target audiences for the workshop are managers and practitioners interested in the implementation of BMD from State DOTs, industry, academia, and consultants. This involves participants from various offices of a State DOT, such as materials, pavement design, construction, and pavement management.

Outcomes

- Upon completion of the workshop, participants will be able to:
- Understand the overall benefits of BMD.
 - Recognize the planning and coordination effort associate with the implementation process of BMD.
 - Identify the tasks that need to be completed for the development and implementation of BMD.
 - Recognize successful key State DOTs practices and experiences related to BMD.
 - Recognize available external technical information and support.

Register Today
 Contact **Derek-Nener-Plante** at derek.nenerplante@dot.gov for more information.

<https://www.fhwa.dot.gov/pavement/asphalt/>

Equipment Loan Program

Equipment Loan Program

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

- ▶ Dielectric Profiling System (DPS) units
- ▶ Paver-Mounted Thermal Profiler (PMTP) units
- ▶ Circular Track Meter (CTM)
- ▶ Laser Texture Scanner (LTS)
- ▶ Handheld XRF Spectrometer
- ▶ SmartJig for IDEAL-CT and IDEAL-RT testing

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 loan of several pieces of equipment to agencies and contractors.

The idea is for the agency and contractor personnel to borrow equipment for various lengths of time to evaluate and determine if it meets their needs. Based on the MATC's past experience, this significantly increases the likelihood of adoption, because the agency or contractor doesn't have to buy an expensive piece of equipment only to find that it may not meet their needs. The equipment loan can last from a duration of few weeks to several months.

EQUIPMENT AVAILABLE FOR LOAN

- Paver-mounted infrared (Pave-IR) device
- Circular Track Meter (CTM)
- NDT Pavement Thickness (MIT Scan T3)
- Dielectric Profiling System (DPS) for mat and joint density
- X-Ray Fluorescence (XRF) device for binder composition
- Jig set for fatigue testing (I-Fit, TxOT) in AMPT device
- CoreLok for bulk specific gravity of cores
- Rapid Laser Texture Scanner for Macrotexture

In order to obtain additional information on the equipment listed above, please see the MATC website at [HTTPS://WWW.FHWA.DOT.GOV/PAVEMENT/MATC](https://www.fhwa.dot.gov/pavement/matc)

Equipment Loan Program

Equipment Loan includes:

- ▶ Pre-Loan virtual meeting
- ▶ Onsite training by MATC or Resource Center
- ▶ Mid-Loan period check-in
- ▶ Assistance with data extraction & analysis
- ▶ Post-Loan virtual briefing to go over results & describe your experience with the technology
- ▶ “Lessons Learned” document (for some loans)
- ▶ Return borrowed equipment to FHWA

Federal Highway Administration
Office of Preconstruction, Construction, and Pavements
FHWA Mobile Asphalt Technology Center (MATC)

Equipment Loan Record

Requester First Name:	<input type="text"/>	Requester Last Name:	<input type="text"/>	
Equipment Name / Type:	<input type="text"/>		Info filled by the FHWA MATC Staff	
Model No./Serial No. /Details:	<input type="text"/>			
Organization Name:	<input type="text"/>	Loaned to/Shipping Address:		<input type="text"/>
Estimated duration of loan:	<input type="text"/>			
Return statement:	I confirm that our organization will pay for shipping costs either back to the FHWA TFHRC or to another recipient address that the FHWA designates.			

Info filled by the FHWA

MATC Website

<https://www.fhwa.dot.gov/MATC/>

The screenshot shows the MATC website homepage. At the top, there is a blue header with the Federal Highway Administration logo and navigation links for About, Programs, Resources, Briefing Room, Contact, and Search FHWA. Below the header is a dark blue navigation bar with the word "Pavements" and a sub-menu for "Pavement & Materials" which includes Asphalt, MATC, Concrete, Aggregates, and Materials. A breadcrumb trail reads: Home / Programs / Pavements / Pavement & Materials / Asphalt / Mobile Asphalt Technology Center / Home.

The main content area features a large dark asphalt background. On the left is a white sidebar with a yellow "Home" button and links for About, Focus Areas, Services, and Resources. Below these is a "CONTACT US" section for Leslie Ann Myers, Office of Preconstruction, Construction and Pavements, with contact information: 202-981-2875 and Leslie.myers@dot.gov. A link to join the FHWA Pavement & Materials Email List is also present, along with a link to Pavement Publications.

The main content area has a "SITE VISITS" section with a location pin icon and the text: "Bring our state-of-the-art testing trailer and our expertise to your project for a site visit." Below this is a "Pause Previous Next" navigation bar and a small inset photo of a person in a testing trailer. At the bottom of the main area are four yellow circular icons: "MATC" (with "ABOUT" below), a magnifying glass (with "FOCUS AREAS" below), a handshake (with "SERVICES" below), and a lightbulb (with "RESOURCES" below). A pagination bar with numbers 1 through 5 is visible in the bottom right corner.

Contact Us

Derek Nener-Plante, M.S., P.E.

Pavements and Materials Engineer
FHWA Resource Center

derek.nenerplante@dot.gov

202-763-4017

Leslie McCarthy, Ph.D., P.E.

Senior Asphalt Pavement Engineer
FHWA Headquarters

leslie.mccarthy@dot.gov

202-981-2875

MATC

MOBILE ASPHALT TECHNOLOGY CENTER

**SPREADING ASPHALT PAVEMENT
TECHNOLOGY INNOVATION**

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

Leslie Myers
MATC Program Manager
leslie.myers@dot.gov

Michael Huner
Project Manager
michael.huner.ctr@dot.gov

Derek Nener-Plante
Pavement and Materials Engineer
derek.nenerplante@dot.gov