Michigan County Engineers’ 56th annual workshop
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FHWA MOBILE ASPHALT TECHNOLOGY CENTER
AND OUTREACH TO LOCAL AGENCIES
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Acronyms

- 3D: Three Dimensional
- ABML-ID: FHWA Asphalt Binder and Mixture Laboratory – Implementation Division
- AC: Asphalt Content
- AMPT: Asphalt Mixture Performance Tester
- BMD: Balanced Mix Design
- DPS: Dielectric Profiling System
- FTIR: Fourier Transform Infrared Spectroscopy
- GPR: Ground Penetrating Radar
- IDEAL-CT: Ideal Test for Cracking
- IDEAL-RT: Ideal Test for Rutting
- I-FiT: Illinois Fatigue Test
- MATC: FHWA Mobile Asphalt Technology Center
- MPD: Mean Profile Depth
- PMTP: Paver Mounted Thermal Profiler
- QA: Quality Assurance
- RLTS: Rapid Laser Texture Scanner
- RLTS-C: Rapid Laser Texture Scanner, confined in field
- RLTS-UC: Rapid Laser Texture Scanner, unconfined specimen in lab
- SMA: Stone Matrix Asphalt
- SSR: Stress Sweep Rutting
- XRF: X-Ray Florescence
On Deck: Outreach to Local Agencies

FHWA Infrastructure Programs
• Who we are, what we do in pavements

FHWA Resilient Pavements
• Defining resilience
• Resilience in Transportation Asset Management Plans in regulation
• Adaptation strategies
• FHWA resources available to help agencies

FHWA Mobile Asphalt Technology Center (MATC)
• Program Goals
• Activities and Opportunities for Local Agencies
• Deploying field technology that supports pavement durability and safety
FHWA Infrastructure Programs

Program Offices

Office of Research, Development and Technology

Federal Aid Divisions

Resource Center

Brian Fouch
Director, Office of Preconstruction, Construction and Pavements

Robert Mooney, TL
Preconstruction

Brian Hogge, TL,
Contract Administration & Construction

Gina Ahstrom, TL,
Pavement Materials

LaToya Johnson, TL,
Pavement Design & Performance
Pavement and Materials: Who We Are

- **Richard Duval**: program coordination for Performance Engineered Mixtures and Design and Performance Related Specifications
- **Tim Aschenbrener**: asphalt pavements, Asphalt QA, increased density, asphalt recycling
- **Leslie Myers**: flexible pavements, asphalt materials, Mobile Asphalt Technology Center
- **Mike Praul**: concrete pavements and materials, concrete QA, Mobile Concrete Technology Center
- **Sam Tyson**: long-life concrete pavement strategies, concrete repair strategies, concrete recycling and industrial byproducts, concrete overlays
Pavement and Materials: What We Do

• All things Asphalt Materials
• All things Concrete Materials
• Technologies for pavements and materials
• Movement toward Performance Engineered Pavements
• Pavement Sustainability and Resilience
FHWA Resilience
Application to Pavements
What Is Resilience?

Resilience: the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions, FHWA Order 5520 (FHWA 2014a).

Resilience in Transportation Asset Management Plans in Regulation

23 CFR Part 515.7

State DOTs are required to develop a risk-based asset management plan to include specific minimum processes including the following section on life cycle planning identified in subsection (b)*:

- A state DOT shall establish a process for conducting life cycle planning for an asset class or asset subgroup at the network level (network to be defined by the state DOT). As a state DOT develops its life cycle planning process, the state DOT should include future changes in demand; information on current and future environmental conditions including extreme weather events, climate change, and seismic activity; and other factors that could impact whole-life costs of assets.

*Similar requirements are in subsection (c) which addresses Risk Management Plans
Adaptation Strategies:

1. Monitor Trends

Most predicted changes to environmental variables are projected to occur relatively slowly in relation to a typical infrastructure lifecycle (FHWA 2015).

Key pavement indicators to monitor for climate change impacts.

<table>
<thead>
<tr>
<th>Asphalt Pavement Indicators</th>
<th>Concrete Pavement Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutting of asphalt surface</td>
<td>Blow-ups (JPCP)</td>
</tr>
<tr>
<td>Low temperature (transverse) cracking</td>
<td>Slab cracking</td>
</tr>
<tr>
<td>Block cracking</td>
<td>Punch-outs (CRCP)</td>
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<tr>
<td>Raveling</td>
<td>Joint spalling</td>
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<tr>
<td>Fatigue cracking and pot holes</td>
<td>Freeze-thaw durability</td>
</tr>
<tr>
<td>Rutting of subgrade and unbound base</td>
<td>Faulting, pumping, and corner breaks</td>
</tr>
<tr>
<td>Stripping</td>
<td>Slab warping</td>
</tr>
<tr>
<td></td>
<td>Punch-outs (CRCP)</td>
</tr>
</tbody>
</table>

Source: FHWA.
(FHWA forthcoming a.)
CRCP = continuously reinforced concrete pavement; JPCP = jointed plain concrete pavement.
2. When Trends Differ, Evaluate Vulnerability

Objectives:
- Identify whether an asset is more vulnerable than other system assets.
- Prioritize potential vulnerabilities for the system.

Approach:
- Use the Vulnerability Assessment Scoring Tool (FHWA 2017a).
- Input local asset data.
- Output the relative vulnerability scores per asset.
3. Plan and Design Infrastructure to Meet Future Conditions:

- Use the adaptation decisionmaking assessment process (ADAP).

- Use a risk-based approach for planners, designers, or engineers.

- Tailor to each State.

- Aids decisionmakers in determining which project alternative is best (lifecycle costs, resilience, and regulatory and political settings) (FHWA 2021a).
Working with Partners Across the Country
FHWA Resilience Resources

Gulf Coast 2 Study

(FHWA 2019)

Resilience Pilots with State DOTs and MPOs

(FHWA 2021b) MPOs = metropolitan planning organizations.

Hurricane Sandy Project

(FHWA 2017b)

Engineering Assessments

(FHWA 2017c)

Vulnerability and Adaptation Framework

(FHWA 2019)

Engineering Guidance (HEC-25 & 17)

(FHWA 2014c)

Project Development

(FHWA 2015)

Operations and Maintenance

(FHWA 2017d)

Nature-Based Solutions

(Buckingham and Torossian 2021)

All photos source: FHWA.
References for Resilience


FHWA Mobile Asphalt Technology Center (MATC)
Innovative technologies and practices are implemented by agencies and industry to provide durable, safe, and sustainable asphalt pavements on our nation’s highways.

FHWA MATC Program Goal

- On-site field evaluations & training
- Asphalt materials & field testing
- Innovation implementation
- Equipment loans
- Hands-on and virtual demos
FHWA MATC Focus Areas

▸ Deployment
  ▪ Quality in the Asphalt Pavement Process workshop
  ▪ Recorded video briefs

▸ Troubleshooting
  ▪ On-site: within scope of standard or agency specification
  ▪ In-depth: through the Asphalt Binder and Mixture Laboratory-Implementation Division (ABML-ID)

▸ Post-Construction Evaluation
  ▪ Density
  ▪ Maintenance and preservation treatment selection
  ▪ Pavement surface characteristics (microtexture, macrotexture)
  ▪ Pavement performance monitoring
# Technologies Offered by FHWA MATC

## Mixture
- AMPT suite of tests
- 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 tracking test

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

## Field
- Paver-mounted thermal profiler (Pave-IR)
- Pulse induction technology for in-place pavement thickness
- Pavement texture measurements (3 methods)
- Dielectric profiling systems (DPS)
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
Actual Measured Core thickness and Pulse Induction measurements found to be same.
Asphalt Pavement Macrotexture

- Significant focus on adding life (durability) to dense-graded mixes over the past several years
  - Concern that macrotexture may be compromised
- Macrotexture – mix surface voids, aggregate gradation driven
  - Provides voids/channel to evacuate water – more critical at higher speeds
  - Provides friction from hysteresis – hysteresis increases with speed – more critical at higher speeds
  - FHWA is investigating macrotexture testing procedures that could be used in mix design, mix verification, and field verification
Sand Patch
Laser Texture Scanner in Lab or Field

- Lightweight, portable, rapid, 3D scanner
- Utilizes a 100-mm laser line and travels 100 mm to collect a sq. area
- Measures macrotexture on freshly compacted mats in field and on cores or gyratory specimens in lab
Mean Profile Depth (MPD) – Field Measurements

Stone Matrix Asphalt (SMA) – MPD Typically exceeds 1.0 mm (0.04 in) according to 2008 AASHTO Guide for Pavement Friction
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
How it works?

➢ Real-time Data Visualization and Communication Between Plant and Paver to Minimize Temperature Differentials While Paving Operation

Contractor monitors from plant

DOT can monitor from the Office

Images: SHRP2 (R06 C)
Data from PMTP Technologies

Cumulative Distribution of Mat Temperature

Distribution of Placement Temperatures

- Date: 6 - 24 - 21
- Date: 6 - 29 - 21

Mean: 300 °F
Median: 302 °F
σ: 10.62 °F

Mean: 303 °F
Median: 303 °F
σ: 10.85 °F

Distribution of Paver Speed

- Date: 6 - 24 - 21
- Date: 6 - 29 - 21
Dielectric Profiling Systems (DPS)

- Testing equipment that uses high frequency ground penetrating radar (GPR) to nondestructively assess asphalt pavement density
- Reduce turnaround times
- Perform continuous density measurements over larger areas
- Dielectric profiling systems (DPS) address many of the issues with traditional density measurement techniques
Use of DPS Data

Low Dielectric Value → Higher Air Void Content → Lower Density

High Dielectric Value → Lower Air Void Content → Higher Density

\[ y = 150.66e^{-1.448x} \]

\[ R^2 = 0.7527 \]
DPS – Heat Maps

• Shows the uniformity of the asphalt mat after rolling
• Helps identify low density areas
  • e.g. start of pass, along paving joint, etc.
• View heat maps real time

Source: FHWA
MATC – Technology Transfer

▸ Use MATC as a communication vehicle to stakeholders

▸ Use short communication bursts (1-pagers, social media, etc.) to raise awareness on FHWA efforts

▸ Current Topics:
  ▪ Enhancing in-place density
  ▪ Dielectric profiling systems: Ohio DOT experience
Ongoing MATC Support

▶ MATC project visits since 1988

https://www.fhwa.dot.gov/pavement/asphalt/trailer/events.cfm
Typical Site Visit by MATC

Planning Call with DOT and FHWA Div.

Logistics with DOT and Contractor

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

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

On-Site Testing at Plant and Field sites

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

Final Close-out Webinar & Report with DOT, Contractor, SAPA, and FHWA Div.

Start 1-hr call webinar

During 60 days emails

First week on-site 2-hr meeting & call-in

2nd week on-site 2-hr presentations (plus web access), 2-hr tour at MATC

2.5 – 3 weeks at MATC and at paving site

End of last week at MATC 1-hr meeting

Within 90 days after site visit 1.5-hr webinar

Total Time: 6 mos.

Onsite Time: 3 weeks
What can the FHWA MATC do for you?

- Project Site Visits (coordinate via FHWA division office & state DOT)
- Specification Review
  - Comparison to Gold Medal Density states is popular
- Balanced Mix Design Data Analysis
- Technology Transfer
- ABML-ID program for in-depth troubleshooting or rapid research
- Equipment Loan Program
- Quality in the Asphalt Paving Process 2-Day On-site Workshop
THANK YOU!

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