

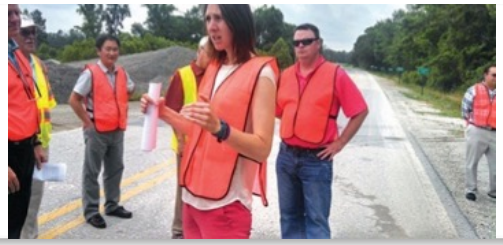


SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Ground Penetrating Radar Pavement Density Validation

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NESMEA

Newark, Delaware
October 18, 2016

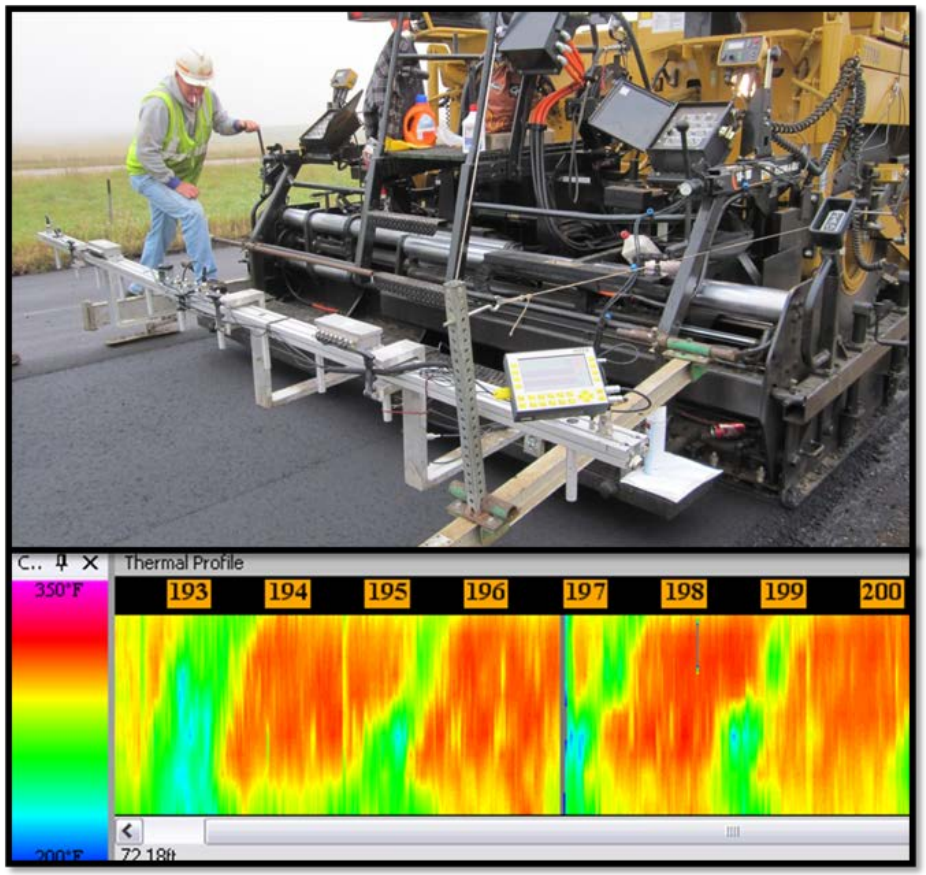
U.S. Department of Transportation
Federal Highway Administration

MaineDOT

American Association of State Highway and Transportation Officials
AASHTO

Presentation Overview

- Maine's need for improved asphalt evaluation
- Testing of Ground Penetrating Radar technology
- Interim results
- Next steps



Maine's Transportation Needs

- Concern about quality of asphalt pavement construction
- Between 4,000 – 12,000 tons of pavement replaced annually due to defects
- Substandard practices cannot always be identified with current random sampling
- Tool needed to improve consistency of laydown practices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Quality Characteristics

- Smoothness
  - Easily measured with current technologies
- In-place density
  - Density gauges or core samples
  - Random sampling; not complete evaluation
- Surface uniformity (seldom measured)
  - Difficult to measure with current methods

SHRP2 Solution

Rapid Technologies to Enhance Quality Control on Asphalt Pavements (R06C)

Two non-destructive techniques for evaluating asphalt pavements during construction

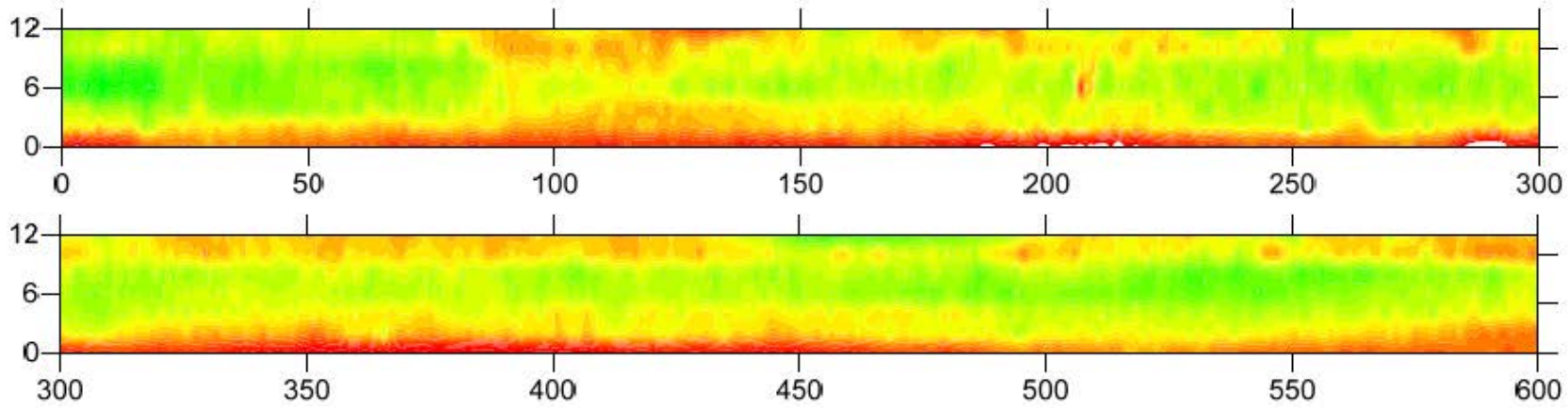
- Infrared thermal scanning
- Ground Penetrating Radar

- Measures uniformity and potential defect areas in asphalt pavements during construction.
- Offers real-time testing of potentially 100 percent of the pavement area.

SHRP2 Solution - GPR

Rapid Technologies to Enhance Quality Control on Asphalt Pavements (R06C)

- GPR technology provides density data over a greater area
- Can identify areas of low density quickly
- Potential to provide better information for QC and Acceptance



Early Efforts with GPR

NCHRP IDEA Project 61 – "Development of a Portable Pavement Thickness/Density Meter"

- Goal – portable GPR device to measure thickness & density in real time
- Help achieve more uniform pavement layers
- Tried several GPR configurations on various test sites – correlated to cores
  - Thickness showed strong correlation
  - Density correlation not as strong

Early Efforts with GPR

Early Efforts with GPR

SHRP2 R06C research - GPR

- Built upon past work – focused on density, not thickness
  - Texas Transportation Institute
  - Finland
- New device measures surface dielectric
- Software correlates dielectric value to air voids

SHRP2 Validation Project research team:

Lev Khazanovich and Ryan Conway

Department of Civil, Environmental, and Geo-Engineering

University of Minnesota

Technical assistance from GSSI

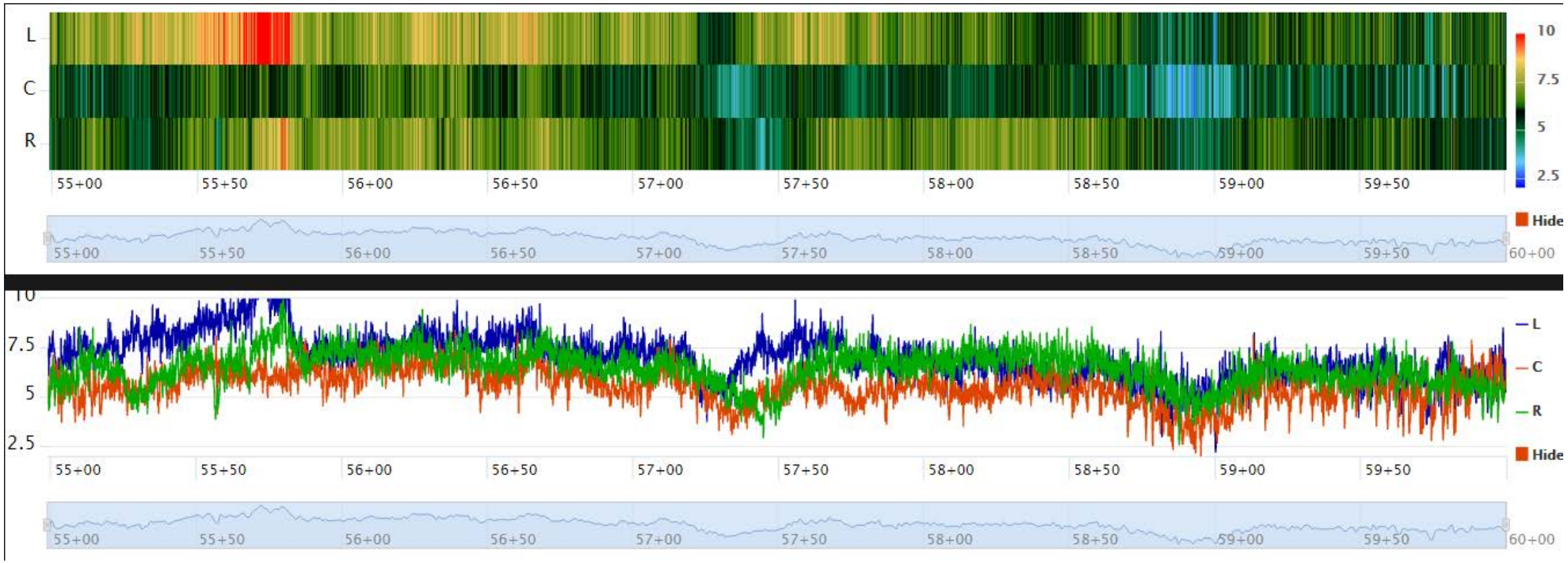
Prototype Rolling Density Meter

- Provides direct readout of density – no post-processing
- Lightweight, portable
- Can be used on thin layers
  - TxDOT ½" overlays
- Needs further validation

GSSI PaveScan RDM

GSSI PaveScan RDM

Density Profiles



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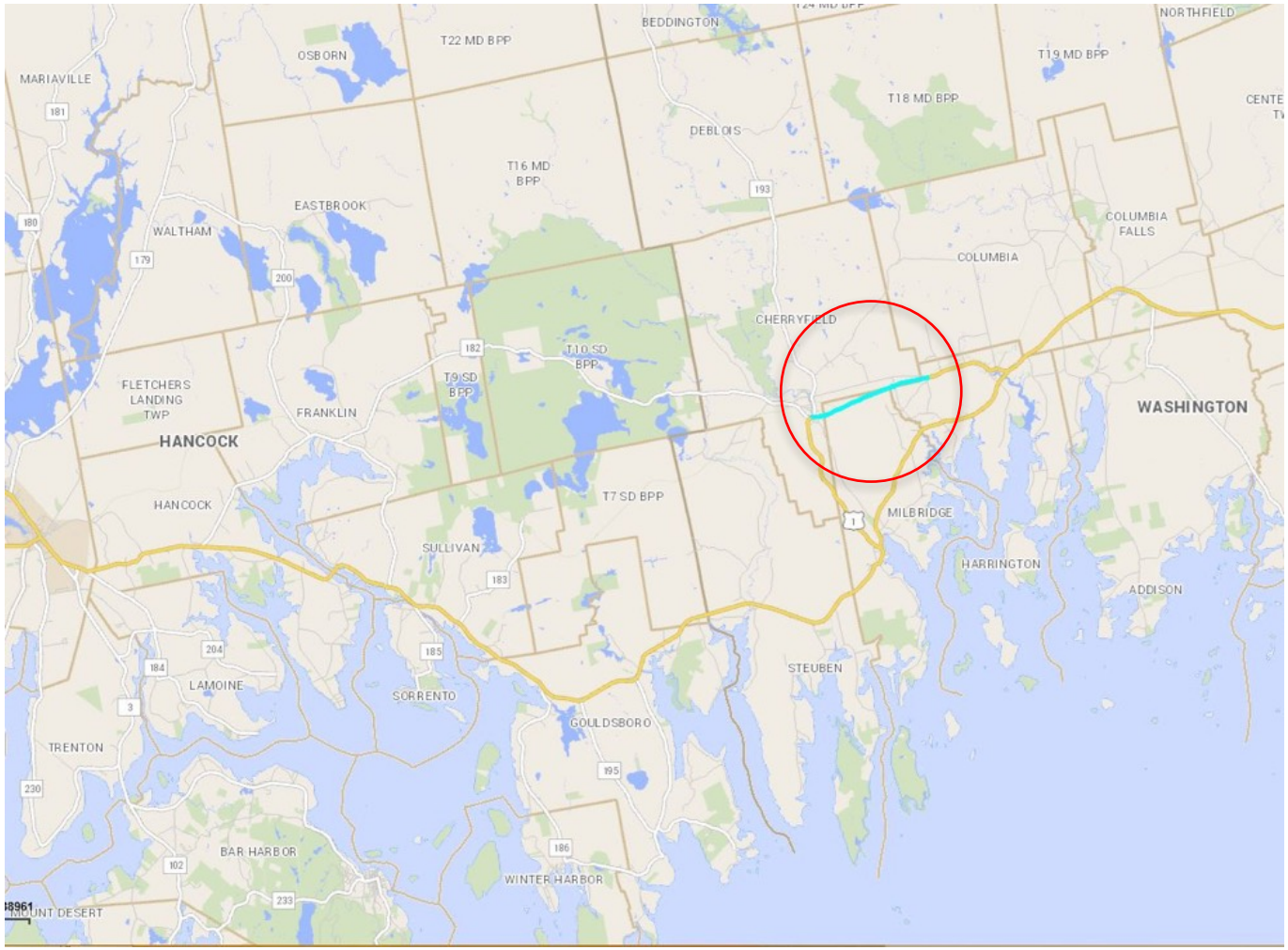
Calibration Procedure

- Scan a pavement section
- Device identifies high, low, median density locations
- Take static reading directly over each location
- Obtain cores for correlation

Calibration Procedure

First project

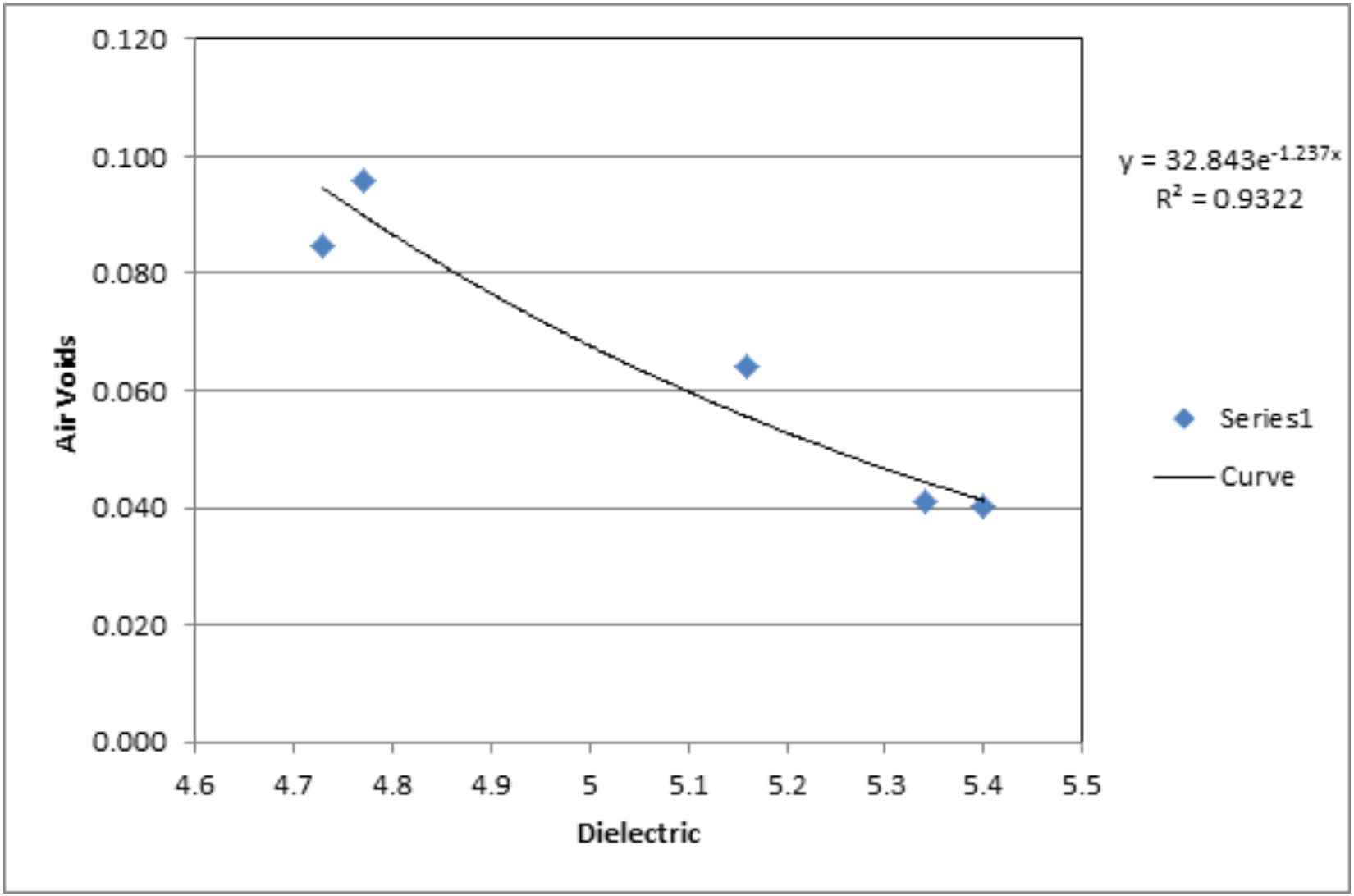
- 4 miles
- 1-1/4” Overlay
- 9.5mm HMA



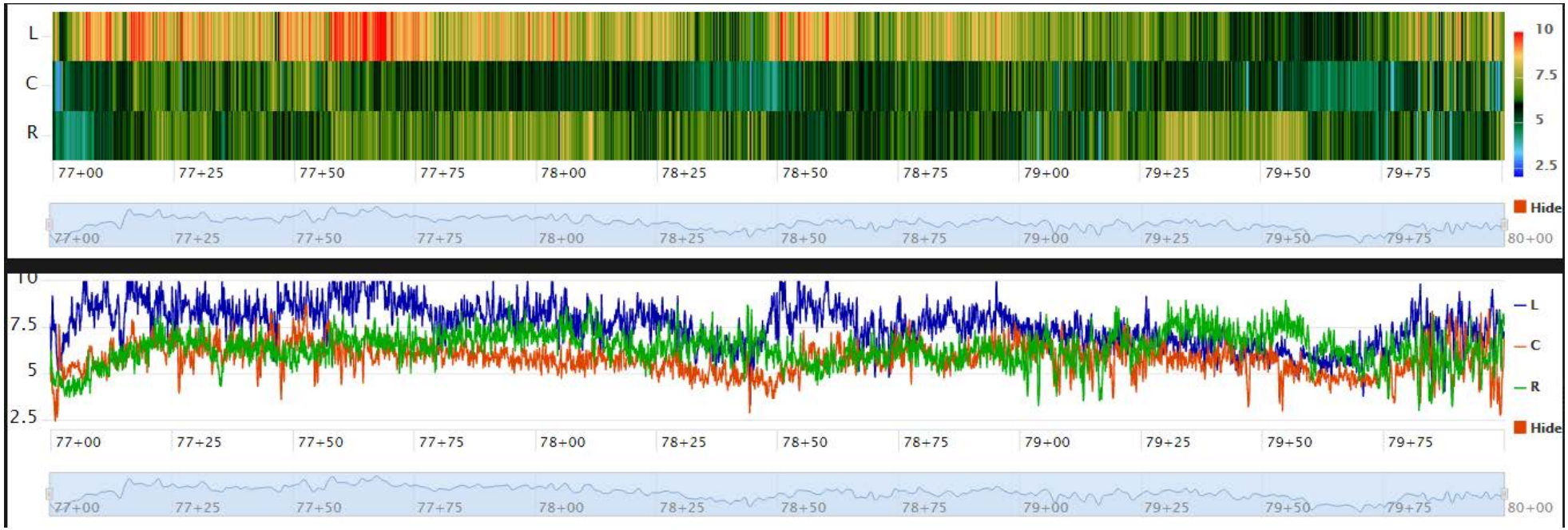
Correlation results

GPR LOCATION	CORE RESULT (% Gmm)
HIGH	95.9
HIGH	96.0
LOW	91.5
LOW	90.4
MEDIAN	93.6
Average Core Density	93.5%
Acceptance Cores	95.6, 91.7, 93.2
Average	93.5%

Regression Analysis



Density Profiles



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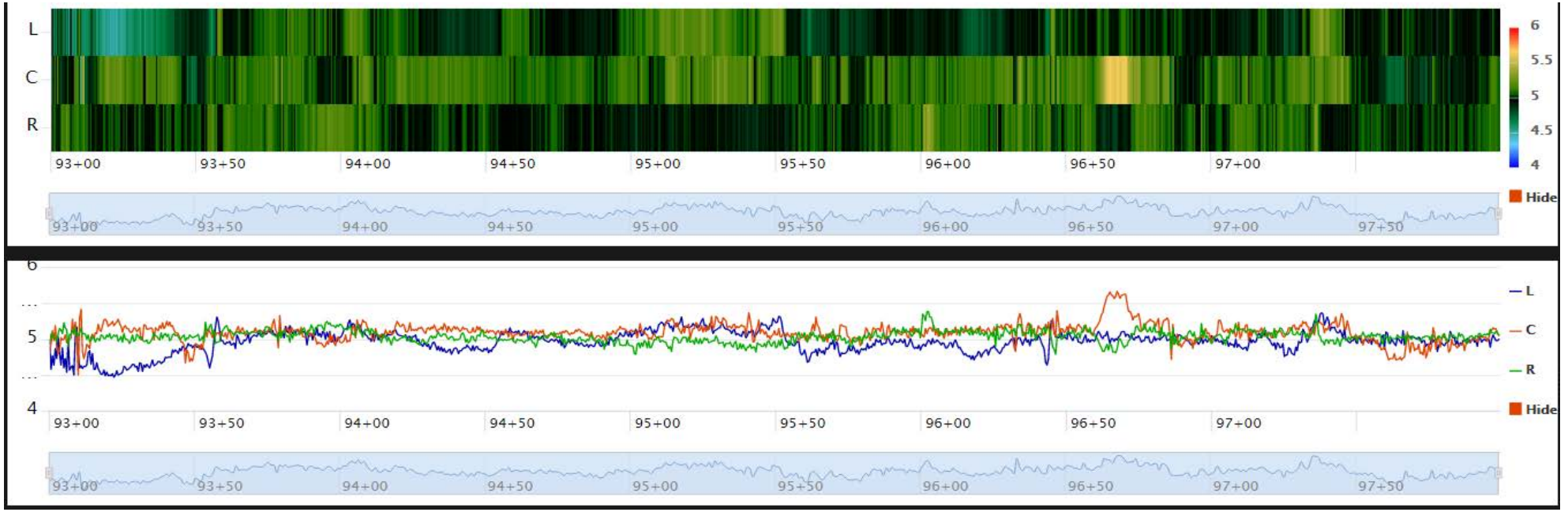
Density Profiles



WHEEL PATH PROFILE

Survey Results

In-Place Air Voids			
	Average	Max.	Std.
Outside Edge	6.22	14.60	1.11
Joint	6.32	18.63	1.12
Wheel Path	5.03	5.92	0.14

Additional Projects

- Project 2
  - 16 miles, I – 95
  - 1-1/2” Mill & Fill
  - 12.5mm HMA
- Project 3
  - 4.5 miles
  - ¾” Overlay
  - 9.5mm HMA
- Work still underway – Calibration correlation not available at this time

Desired Short-term Benefits

- More uniformly constructed hot- and warm-mix asphalt layers
- Better in-place field density
- Improved communication among paving crews, QC, and DOT personnel
- Improved ride
- Less reliance on visual inspection
- Reduced discrepancies between contractor and agency test data

Long-Term Goals

- Better inspection coverage to avoid noncompliance penalties.
- Smoother, longer-lasting pavements.
- Reduced need for corrective action due to low-density asphalt pavements.
- Reduced construction time; fewer incidents of replacing new pavement.
- Lessen exposure of workers and public to work zone hazards.

Next Steps

- Additional validation work in 2017
- Evaluate various applications:
  - Thin overlays
  - Different Mix types
- Portability of calibration
- Ruggedness testing

Next Steps

- Determine best use for device:
  - QC, Acceptance, both?
- Contractor education
- Demonstration projects
- Specification development

For more information

For more information on improving the quality of your asphalt pavements through SHRP2 products contact:

- Steve Cooper (FHWA) stephen.j.cooper@dot.gov
- Evan Rothblatt (AASHTO) erothblatt@aashto.org

For more information on Maine's experience, contact:

- Rick Bradbury (Maine DOT) Richard.Bradbury@maine.gov

MaineDOT

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