ESS Pavement Scanner

Dielectric Profiling Systems

User Group Peer Exchange

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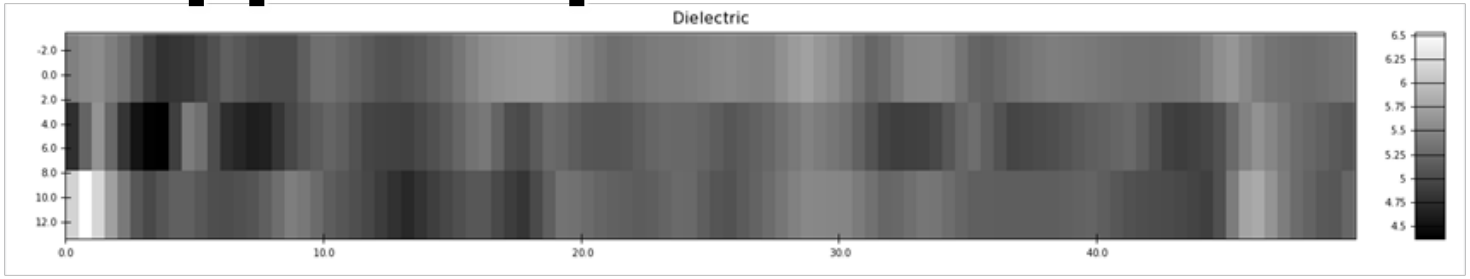
Mapped Asphalt Mat Assessment



- Dielectric constant (radar)
  - AASHTO PP 98-19
- Compaction or density (radar)
- Additional measurements
  - Asphalt mat thickness (radar)
  - IR surface temperature (segregation)
  - Surface ride / roughness (height/accels)
  - Surface cant / camber (accelerometer)

Easy to Use

- No Cables, WiFi, Bluetooth
- Cart, scan head, handle, tablet PC
- Push pins and thumb screws

Two minutes

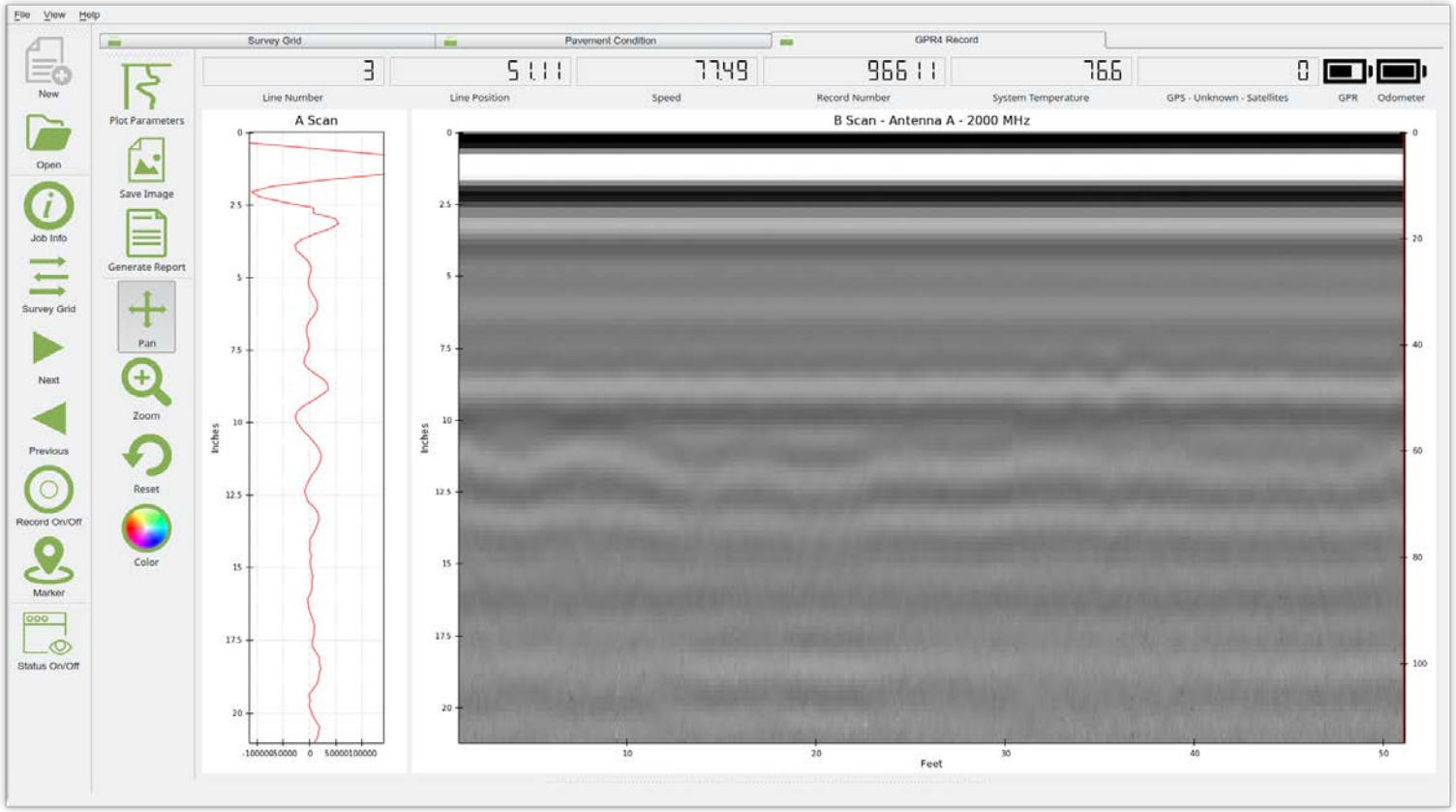
Diverse Sensor Array

- 2 GHz GPR
  - Reflection amplitude
  - Scanner height
- IR surface temperature

- Three component accelerometers
- Wheel odometer (Bluetooth)
- Internal dual band GPS (~2-3 meters)
- RTK GPS with ESS base station (~ 1 cm)
- External GPS system (USB serial)

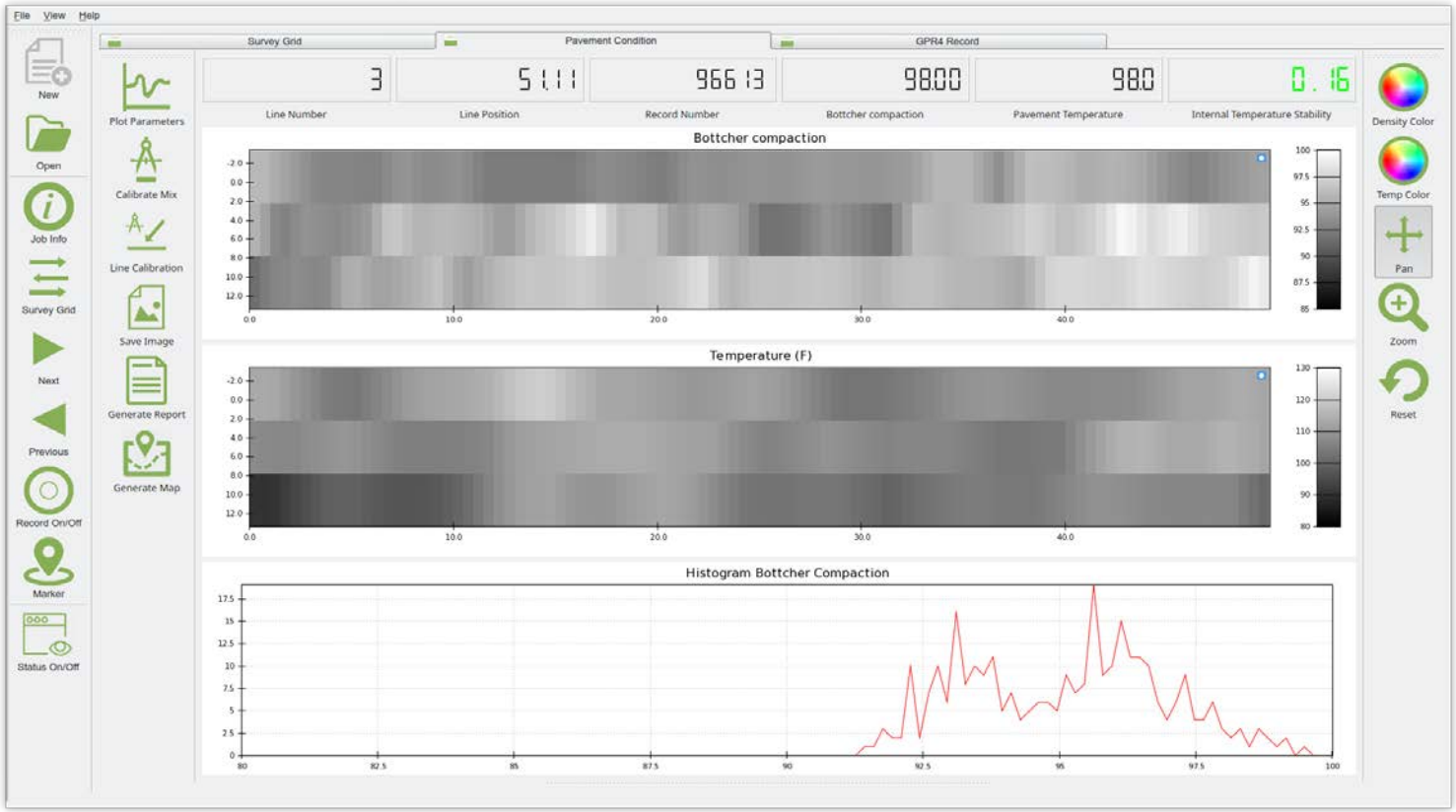
Software: GPR Display

- A-Scan, B-Scan



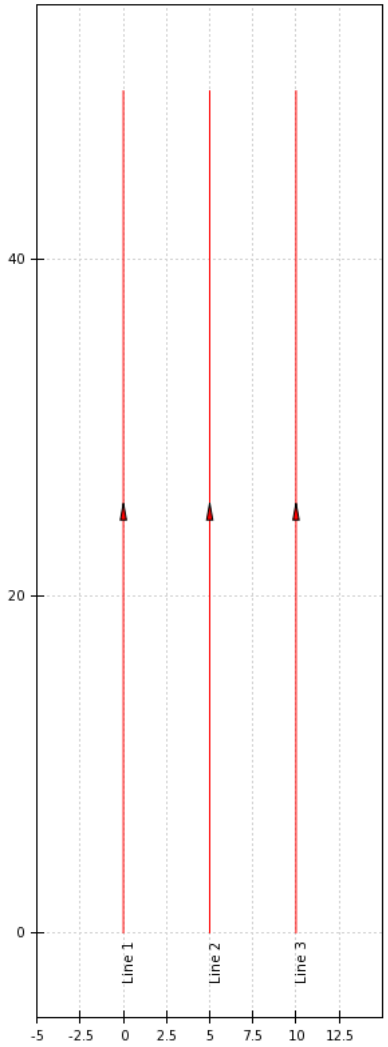
Software: Pavement Display

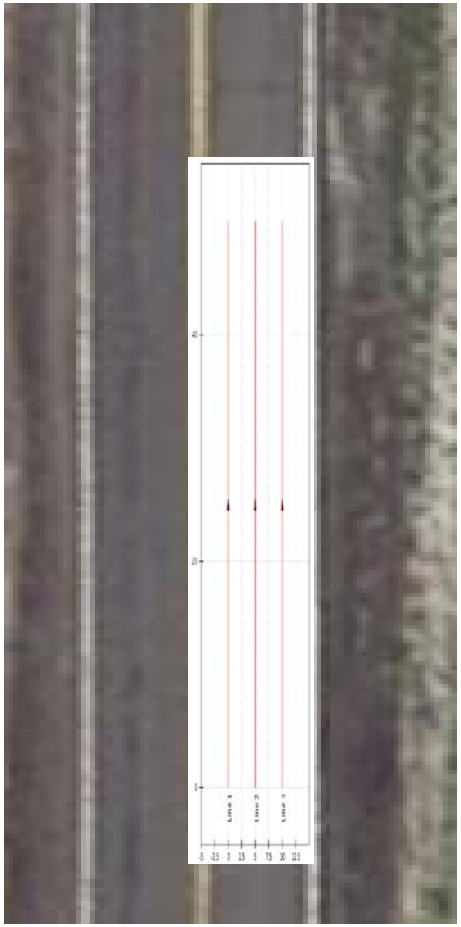
- Dielectric/compaction: 1.5” / 3”, histogram
- Surface temperature



Typical Survey Grid

- Typically one lane
- 3 lines
- 50-500 feet
- Local grid coordinates
- Station coordinates
- GPS coordinates





Data Products

- Google Maps/Earth
  - png, kmz, html
- Reports
  - csv, pdf
- VETA intelligent compaction software (planned)

Dielectric → Compaction

In-Situ Methods: Gauge, Core

- Small in-situ volume not representative of larger Pavement Scanner volume

Core/gauge: 6” Pavement Scanner: 24”

- Density gauge: 2% variation with orientation
- Cores: 1.5% variation from gauge

Dielectric → Compaction

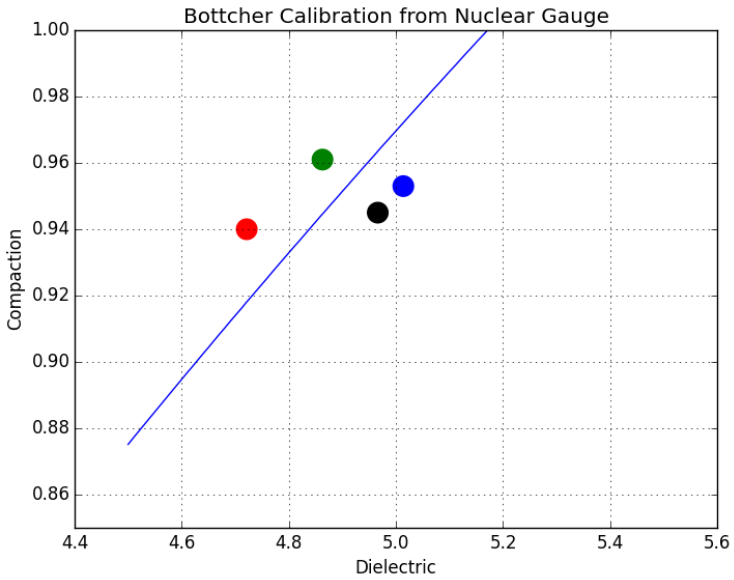
In-Situ Methods: Gauge, Core

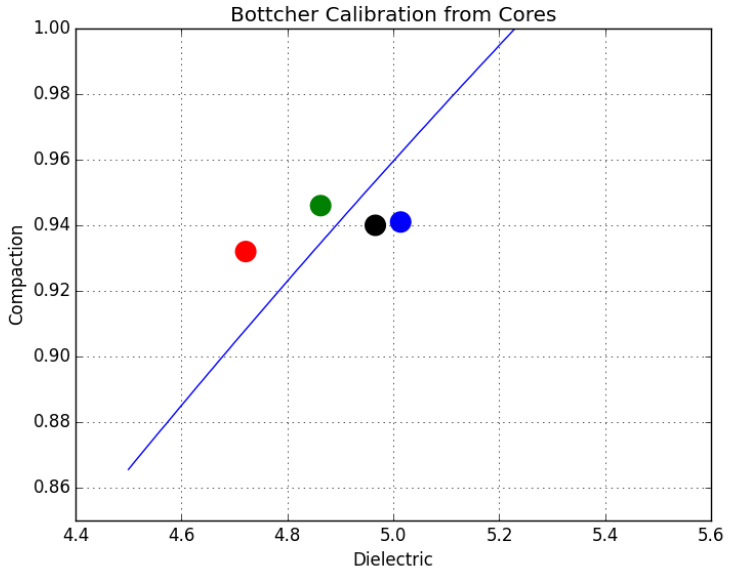
- Measured compaction values from finished mat are usually near target value (~94%)
- Poor results when extrapolating from a small range of calibration points
- Use a theoretical mixing law to extrapolate (Bottcher)
- $\varepsilon_{mix}(\varepsilon_{agg}, \varepsilon_{bind}, \varepsilon_{air}, f_{agg}, f_{bind}, f_{air})$
- $\varepsilon_{mix}(\varepsilon_{agg}, f_{air})$

Dielectric → Compaction

In-Situ Methods: Gauge, Core

- Fast (only a few gauge readings, Rice value)
- Less accurate (+/- 1.9% and +/-1.8%)
  - Need <1% for acceptance





Dielectric → Compaction

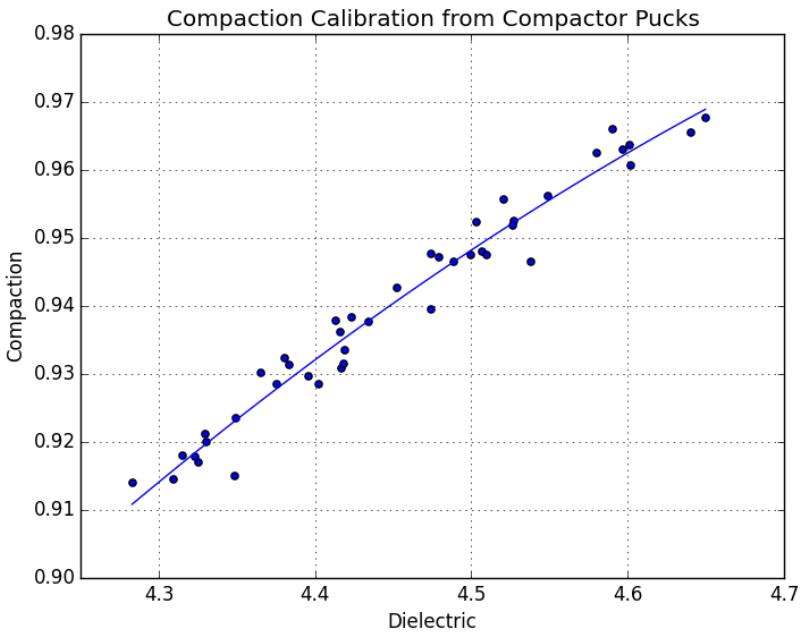
Compactor Puck Method

- Scan head adapter
- Measure dielectric from time-of-flight
- $\text{Sqrt}(\varepsilon)=(c \cdot \Delta t) / (2 \cdot T)$

Dielectric → Compaction

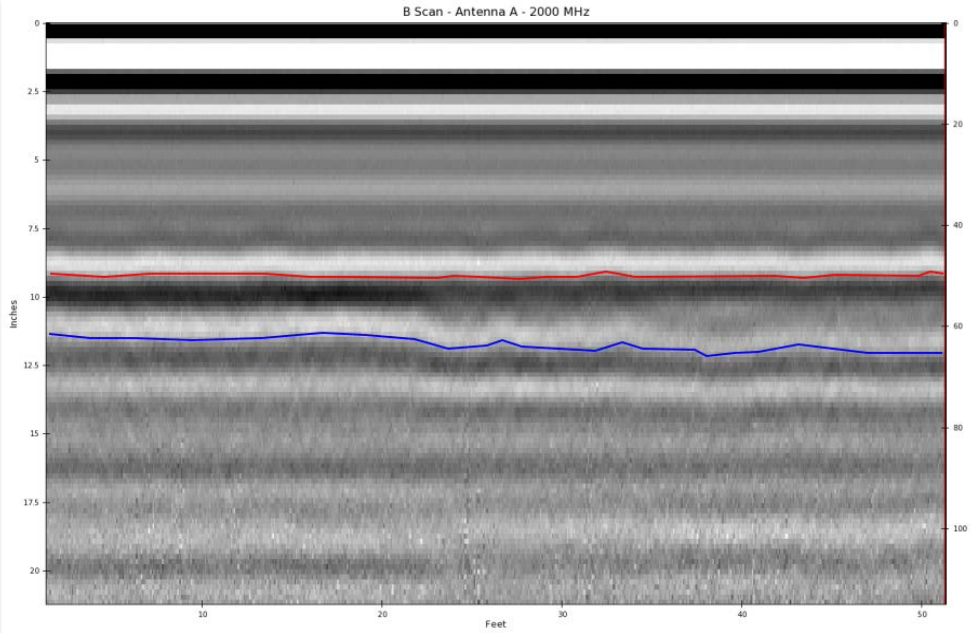
Compactor Puck Method

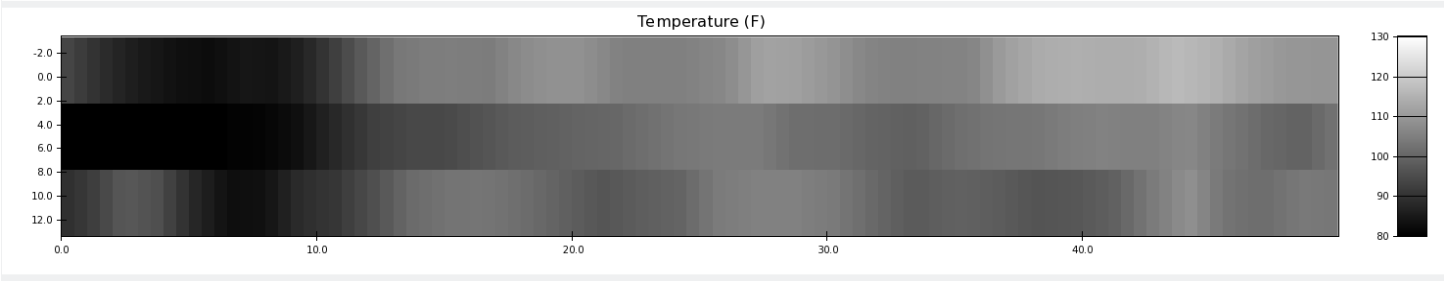
- Fit polynomial
- Uncertainty: +/-0.3%
  - Need <1% for acceptance
- Pucks can span wide range of compaction
- Calibrate instrument for mix before field survey



Additional Measurements

- Mat thickness
- Surface temperature
- Roughness/ride
- Cant/camber
- Photos using tablet PC





Thank You!

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