

NDT Testing Capabilities and Research at the University of Minnesota

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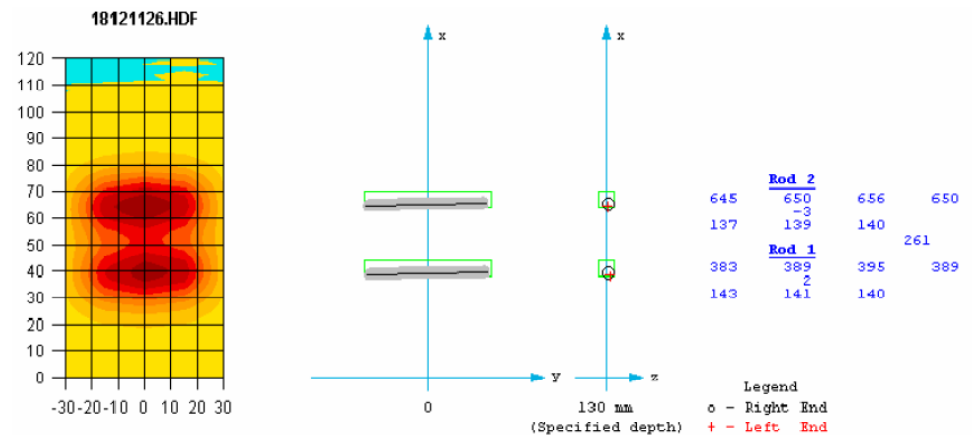
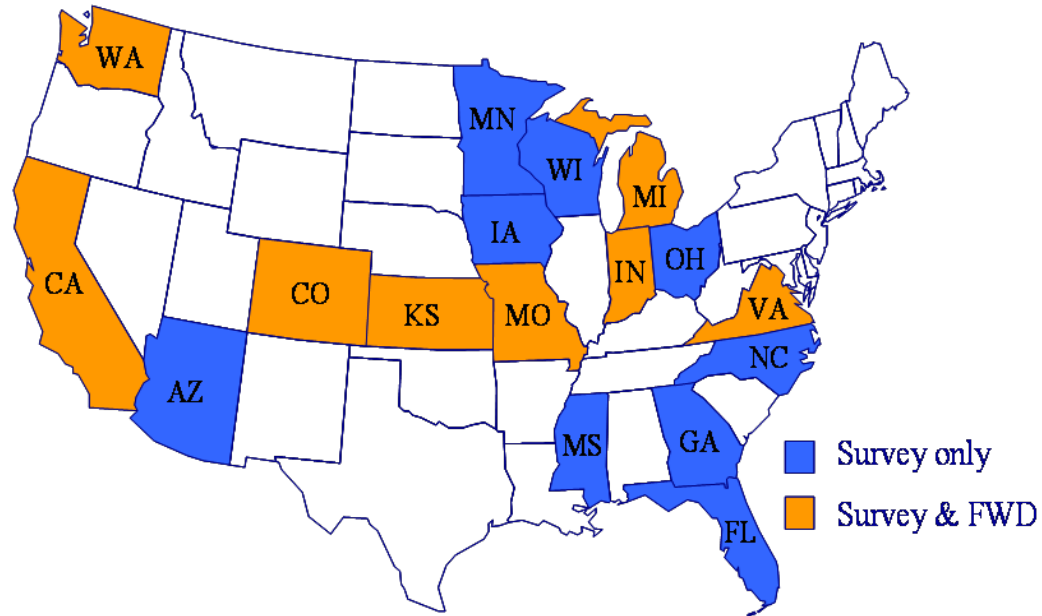
Department of Civil Engineering

Environmental · Geomechanical · Structures · Transportation · Water Resources

- **General outlook**
- **Examples of implementation**
- **UMN Civil Engineering expertise**
- **Goals moving forward**

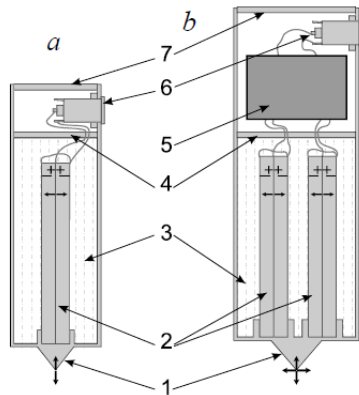
- **UMN has research expertise on a wide variety of NDT methods in**
 - Development
 - Interpretation
 - Implementation
- **Research Status**
 - Many techniques feasible for implementation
 - Need for field verification of techniques

Example: MIT Scan2 - Guidelines for Dowel Alignment in Concrete Pavements



Example 2: MIRA – Ultrasonic Low Frequency Flaw Detector

- Ultrasonic low-frequency 40-probe shear wave pulse-echo device recently manufactured for thickness and flaw detection in concrete
 - Spatially diverse measurements
 - Large amount of transmitting receiving pairs
 - Self Calibrating
 - No surface preparation



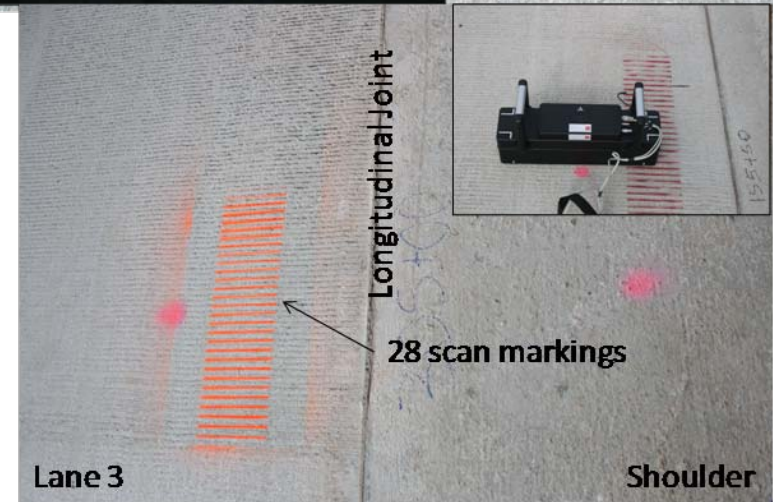
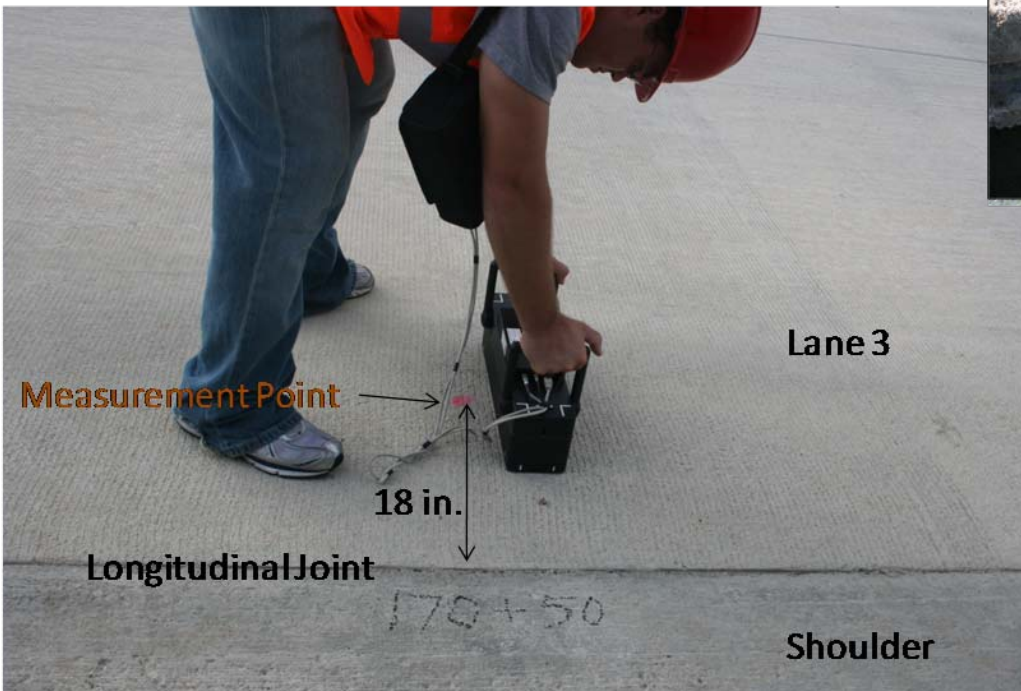
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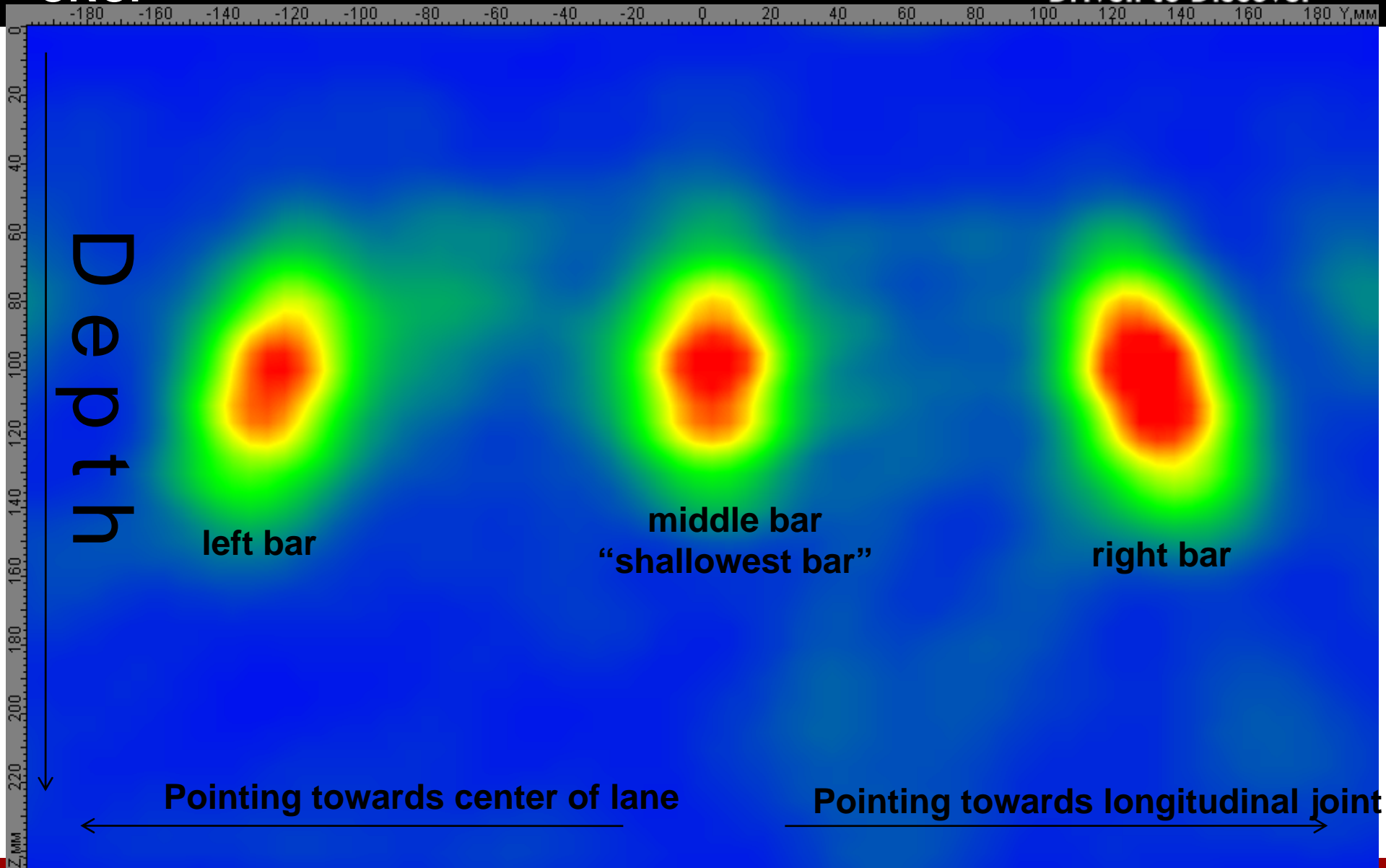


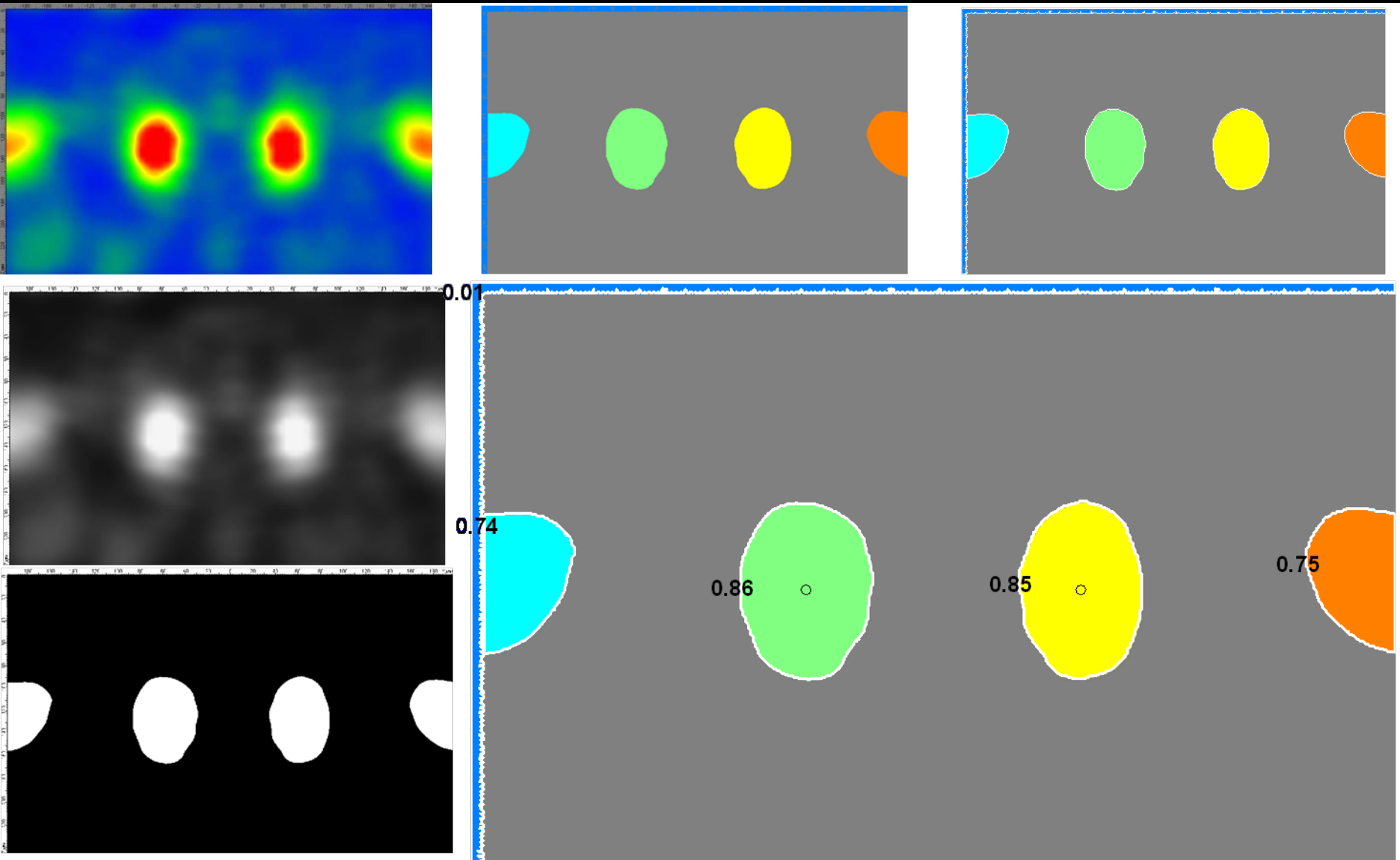
Georgia CRCP Project

Example 2: MIRA - Field Application – 3 Mile CRCP Project

Measurements of CRCP pavement thickness and longitudinal rebar concrete cover for project suspected to have large variations from the specs (about 3 miles of testing in 50 ft intervals).

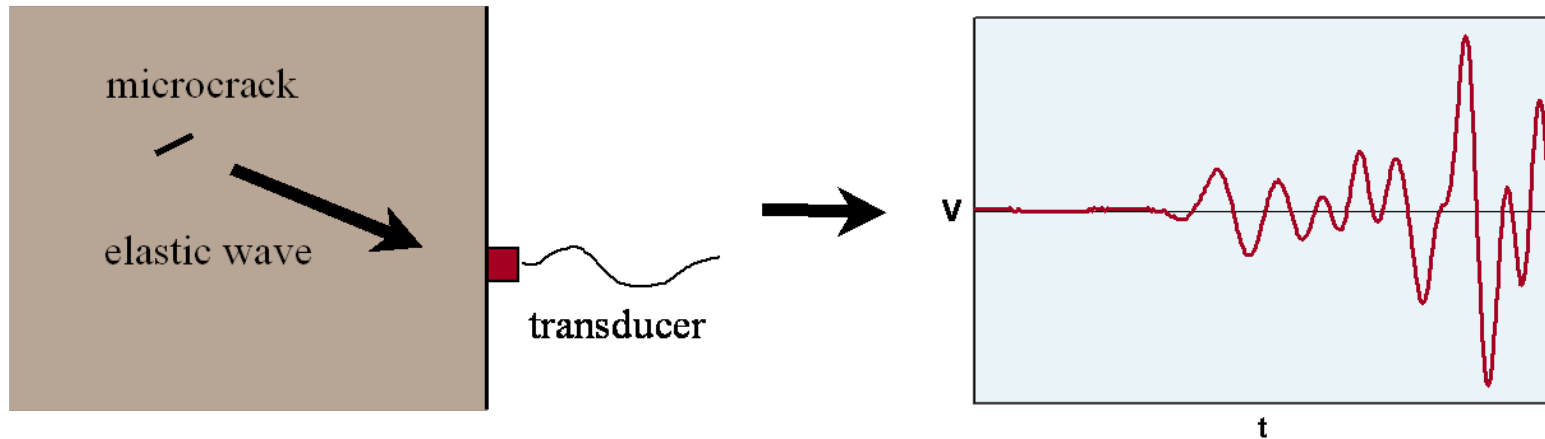




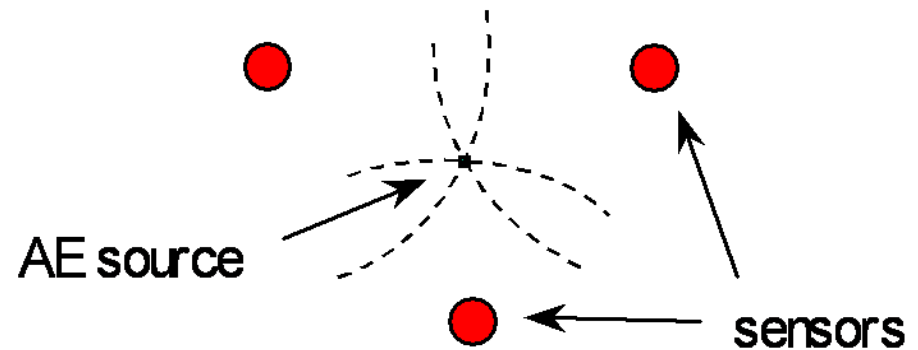


- **Automated signal interpretation for**
 - **Asphalt Pavements**
 - Air void content
 - Debonding at lift interfaces
 - Longitudinal joint quality assessment
 - Thickness
 - **Concrete Pavements**
 - Honeycombing and other distresses
 - Joint deterioration
 - **Bridge Deck**
 - Tearing/delamination
 - Thickness

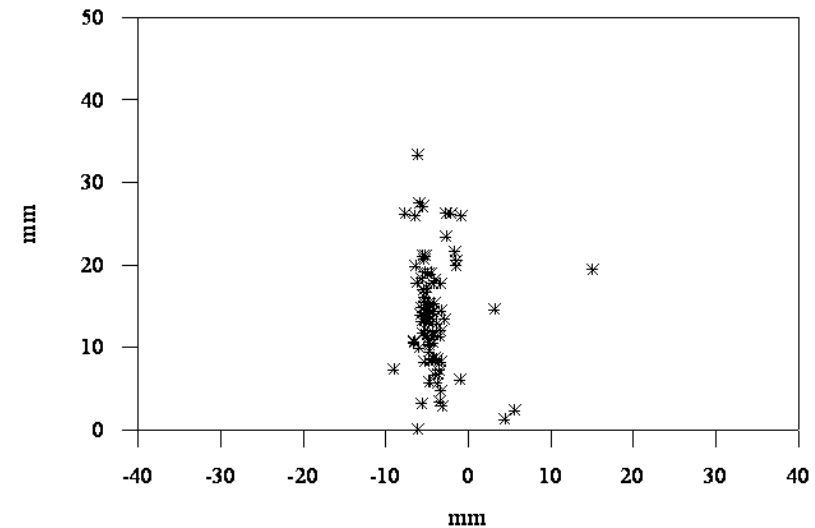
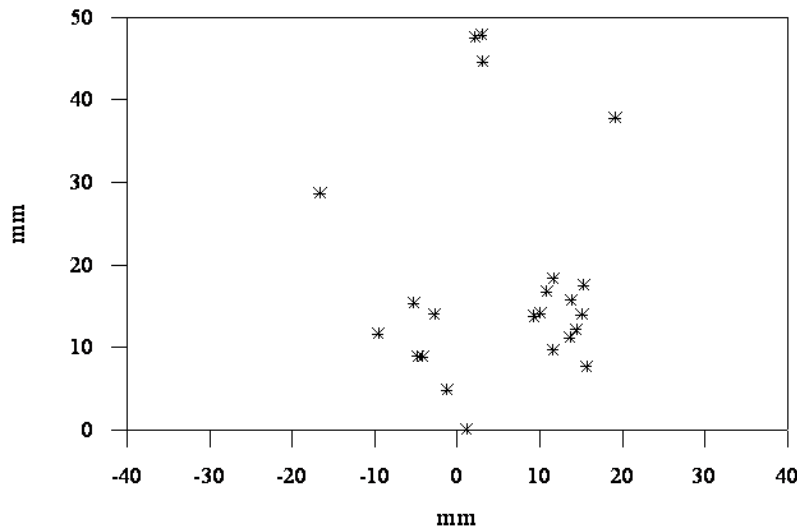
Acoustic Emission (AE)



- **Microcracks generate stress waves called AE.**
- **Use AE statistics or locate AE from relative arrival times.**

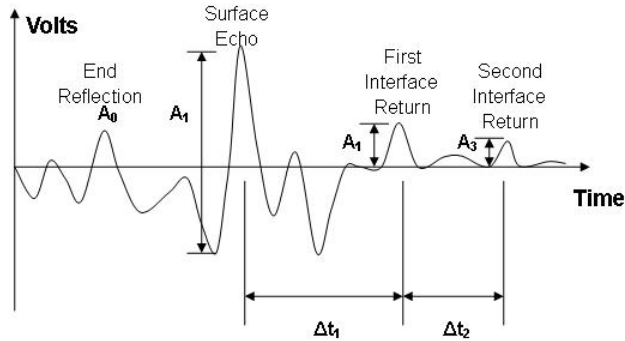


Microcracks in 3PB concrete beam before & at failure:



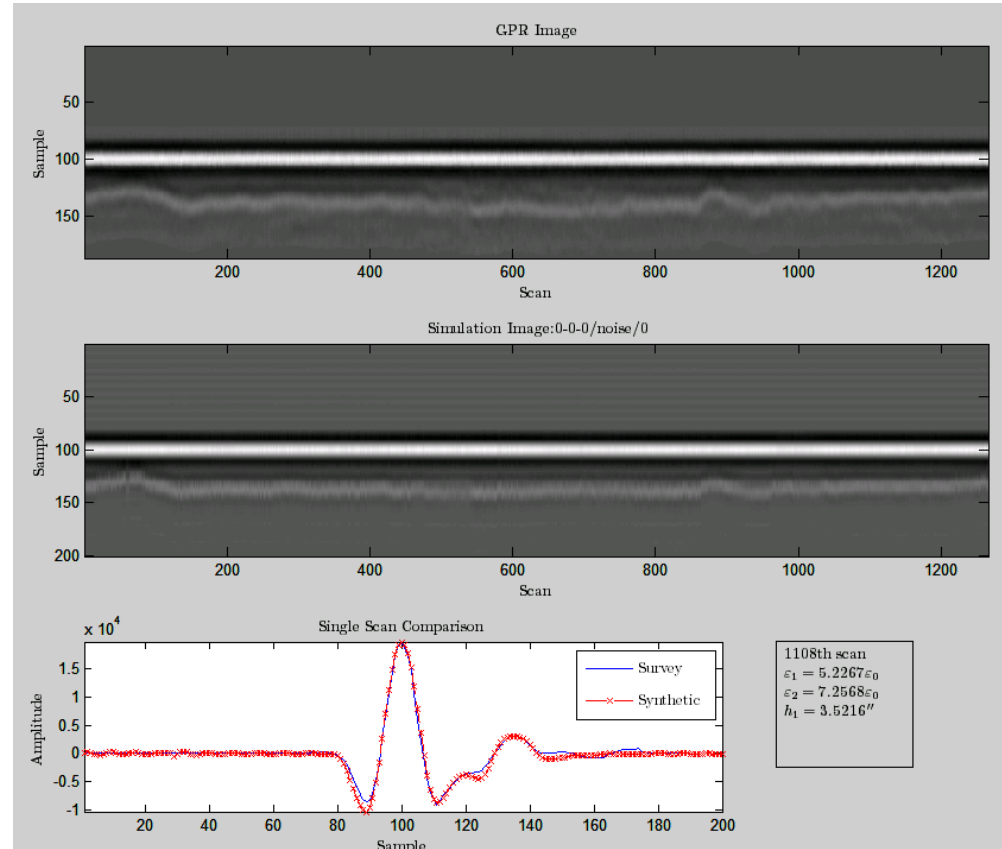
Clustering of AE indicates fracture!

Quantitative Road Assessment from GPR

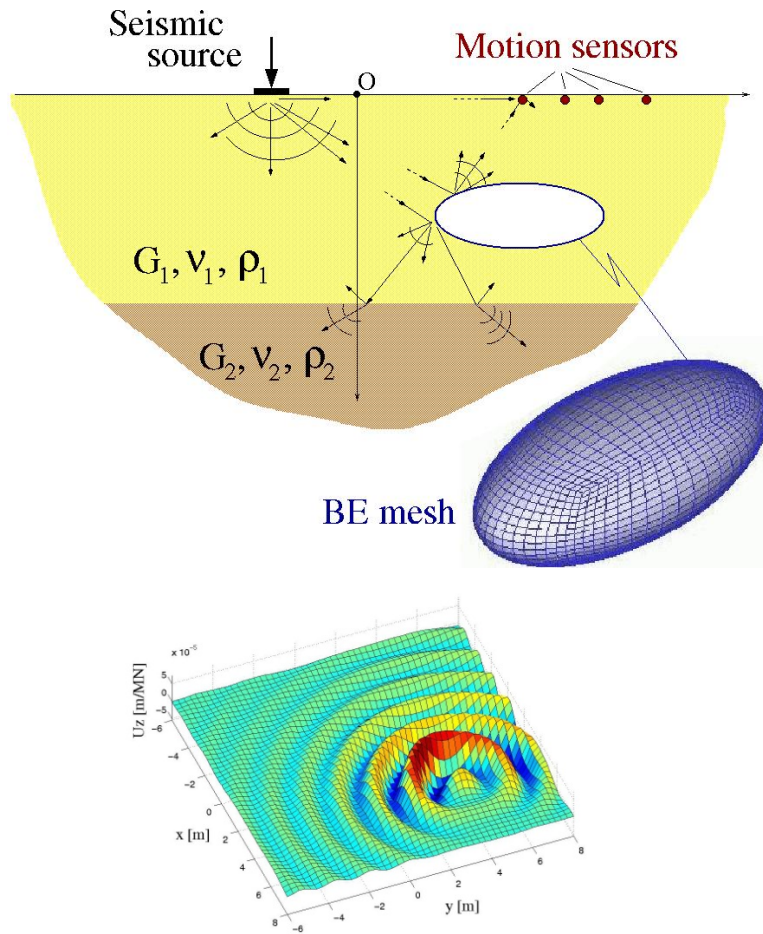


Δt_1 = travel time in asphalt
 Δt_2 = travel time in base layer

Synthetic GPR time histories can be generated for various pavement profiles.



Imaging of underground cavities



Underground cavity illuminated by seismic waves. The presence of internal material interfaces is accounted for via the use of multi-layered Green's functions.

- **Development of new sensors (EE Department)**
- **Data filtering techniques (EE Department)**
- **Batteryless data collection (ME department)**
- **Various expertise accumulated by the BME department**

- **Sustain focus in NDE of infrastructure**
- **Coordinate efforts**
 - **Data Fusion**
- **Transfer from research to implementation**
 - **Verification in “field-like” conditions**

Thank You

Questions?