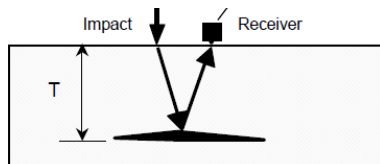


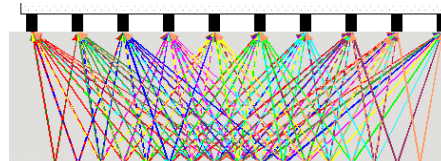
ULTRA SONIC PULSE ECHO (MIRA)

The Ultrasonic Shear-wave Tomography technique (MIRA) represents a revolutionary approach to concrete ultrasonics. MIRA is an ultrasonic tomography device that can be used to diagnose subsurface concrete condition using an array of dry point contact (DPC) “touch-and-go” transducers (doesn’t require surface preparation). Each transducer can both transmit and receive low frequency (55 khz) shear waves. The DPC transducers provide the necessary consistency of impact and wavefront penetration for **diagnostics up to 3 ft deep** for typical concrete surface textures. MIRA incorporates 10 channels each comprised of 4 transducers in a **multi-static array**. This linear array allows for 45 transmitting and receiving pair measurements in each approximately 1 second scan that can be applied at a high productivity (unlike the traditional ultrasonic methods, which

typically produce one pair of waves per measurement).



1 pair per measurement



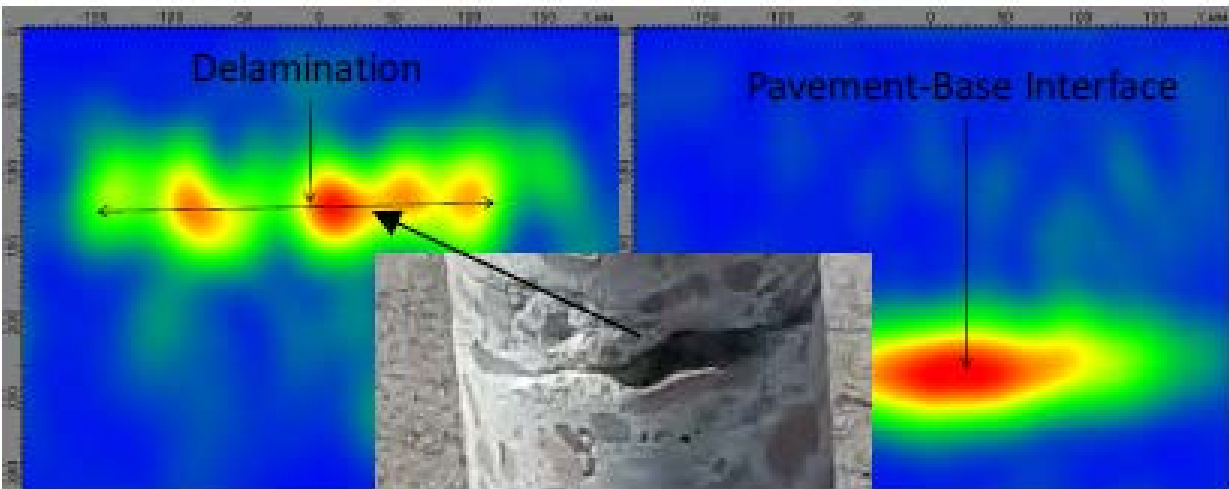
45 pair per measurement (MIRA)

Difference between traditional Ultrasonic Methods and MIRA

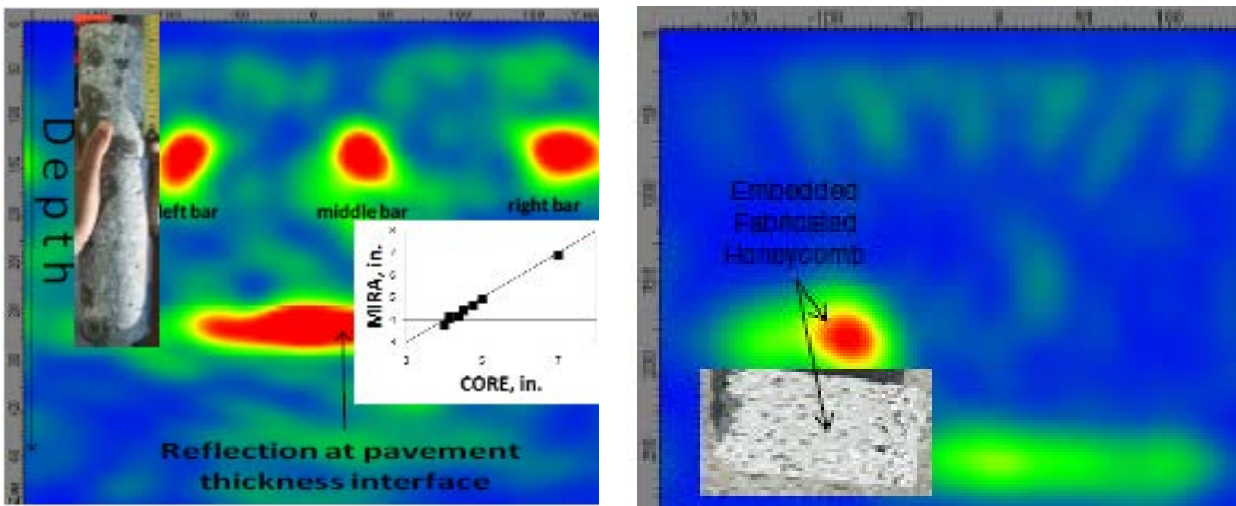
The ultrasonic tomography device, MIRA, can be used for the following applications:

- **Thickness:** Concrete thickness estimation up to 3 feet deep with high accuracy
- **Reinforcement location:** Accurate estimation of reinforcement depth
- **Delamination/debonding:** Detection of cracking in the PCC layer or de-bonding between PCC layers.
- **Joint diagnostics:** Detection of concrete deterioration, dowel position, spalling, etc. at PCC joints.
- **Flaw detection:** Defect/honeycombing/poor consolidation detection/ mud balls
- **Material properties:** Diagnostics of relative PCC strengths or asphalt compaction level

MIRA Visual Output Examples



Delaminating (left) and sound concrete (right).



MIRA detection of reinforcement

MIRA identification of honeycombing defect.

Reference

Hoegh K., Khazanovich L., Yu H.T. "Ultrasonic Tomography Technique for Evaluation of Concrete Pavements." Transportation Research Board 90th Annual Meeting, 2011.

Vendor

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