Getting a Clearer Picture with Geophysics

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Presentation Overview

This presentation will cover…

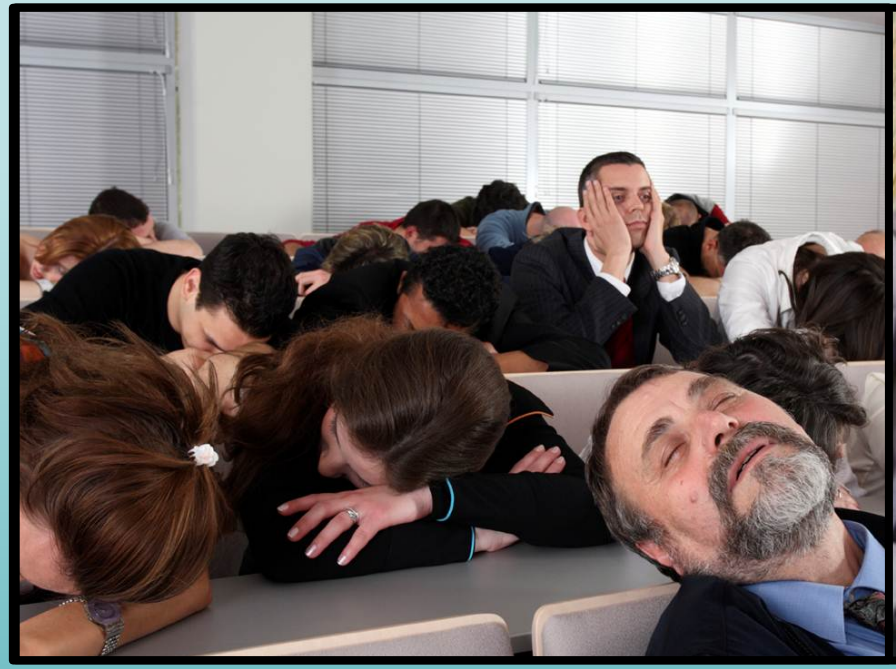
- What is geophysics?
- Why geophysics?
- Methodology and when to use
  - Seismic
  - Resistivity
  - Ground Penetrating Radar
  - Electromagnetics
- Marine Geophysics
- Drilled shaft testing options

This presentation will not cover…

- Specific details of how each method works
- All of the methods available

Because…

It’s Too Early To Do This!



Geophysics, Is It 

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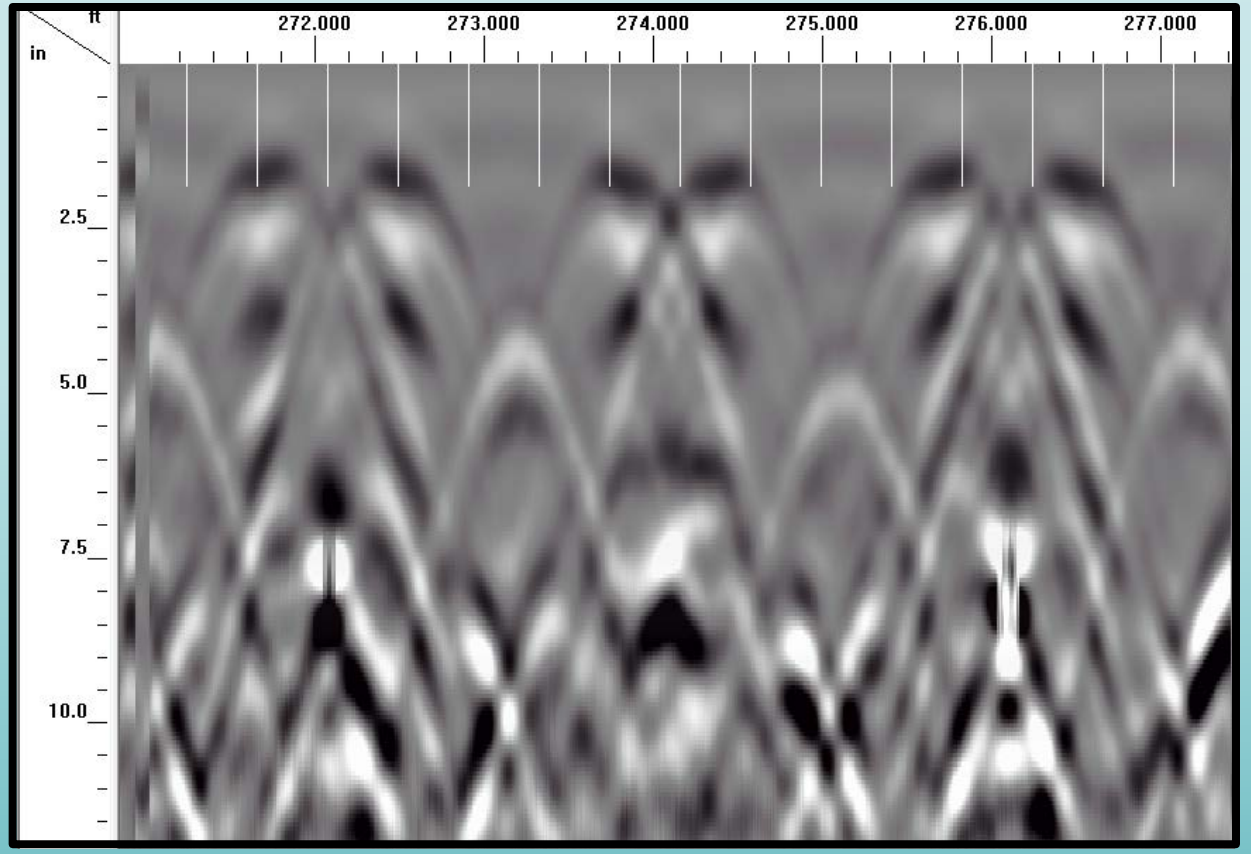

Geophysics Defined

Merriam-Webster

A branch of earth science dealing with the physical processes and phenomena occurring especially in the earth and in its vicinity.

Wikipedia

A subject of natural science concerned with the physical processes and physical properties of the Earth and its surrounding space environment, and the use of quantitative methods for their analysis.

For today's purposes

Derive subsurface information with surface methods or minimally intrusive methods. Better summarized as "really cool stuff!"

Traditional Geotechnical Site Characterization

- Visual observations of the existing surface conditions
- Obtain borings for soil and rock samples
- Install monitoring wells to observe groundwater conditions
- Perform laboratory testing on discrete sampling intervals
- Interpolate/extrapolate data from the very limited data points


Found It!!!
Congratulations, it only took you 65298 seconds
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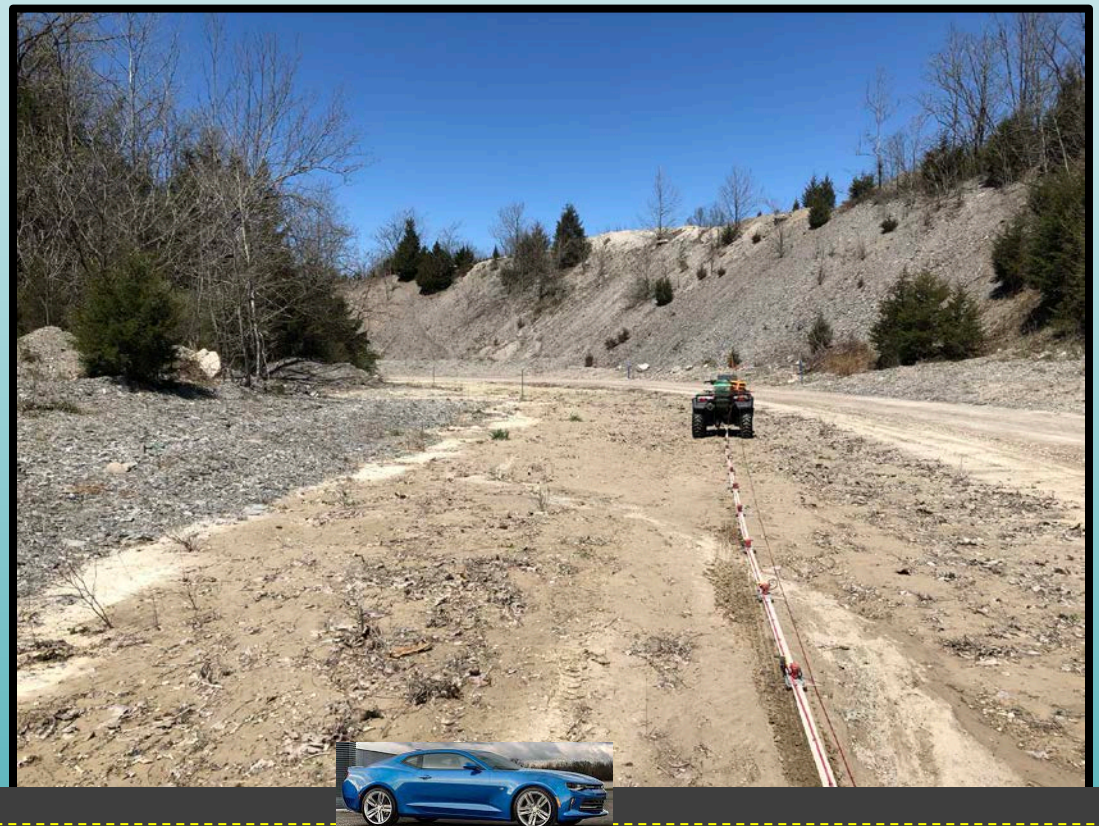
Seismic Applications

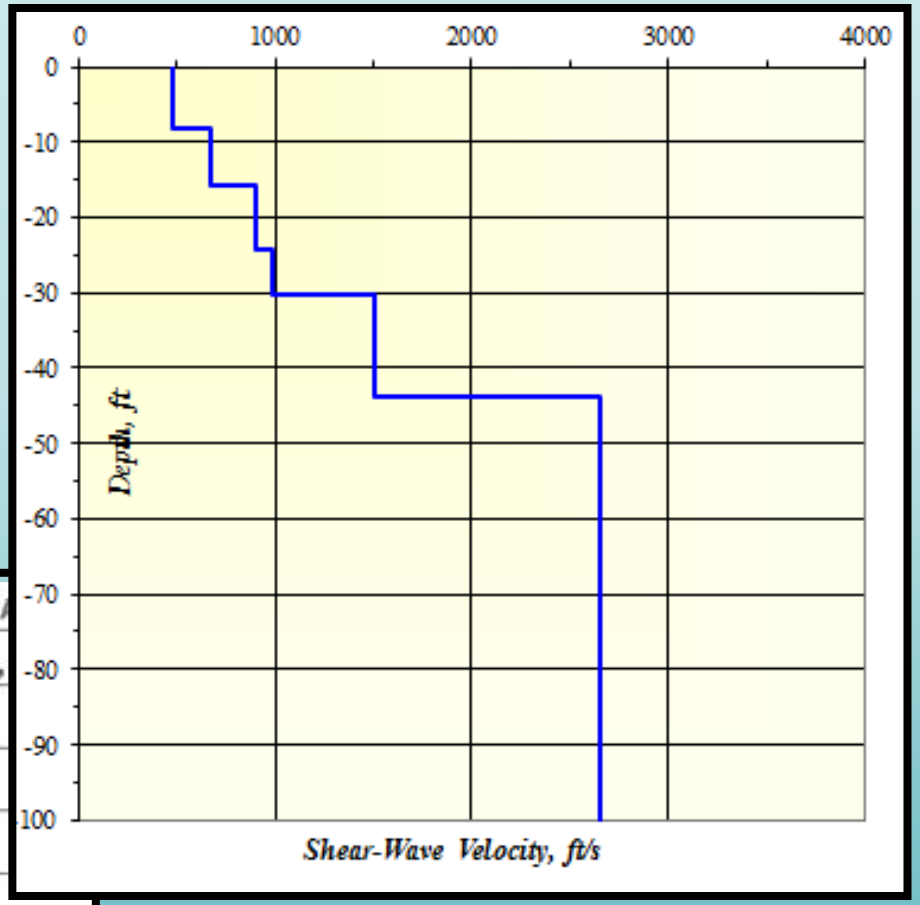
- Determining Seismic Site Classification
- Map bedrock topography
- Rippability of soil/rock
- Locate potential sinkhole/karst conditions



Seismic

AASHTO Site Classification

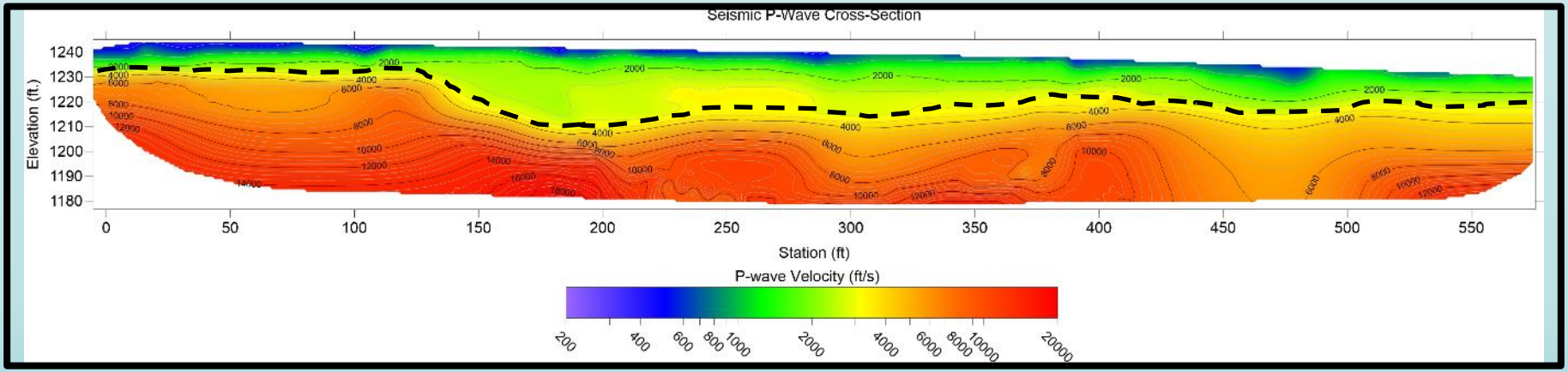
- Least conservative method
- Estimates the shear wave velocity
- Required to assign a Site Class A, often needed to verify a Site Class B, C, or D
- Relatively inexpensive with huge potential cost savings

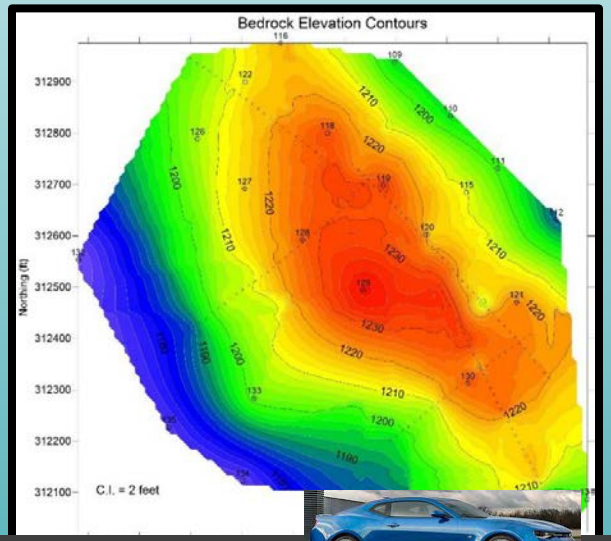


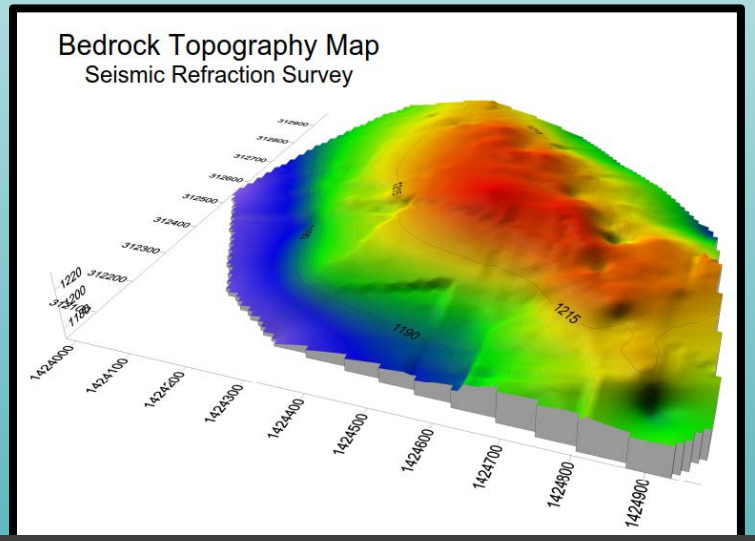
SITE CLASS	SOIL PROFILE NAME	AVERA
		Soil shear wave velocity, $\bar{v}_s$,
A	Hard rock	$\bar{v}_s > 5{,}000$
B	Rock	$2{,}500 < \bar{v}_s \leq 5{,}000$
C	Very dense soil and soft rock	$1{,}200 < \bar{v}_s \leq 2{,}500$
D	Stiff soil profile	$600 \leq \bar{v}_s \leq 1{,}200$
E	Soft soil profile	$\bar{v}_s < 600$

Seismic

Mapping Bedrock Topography

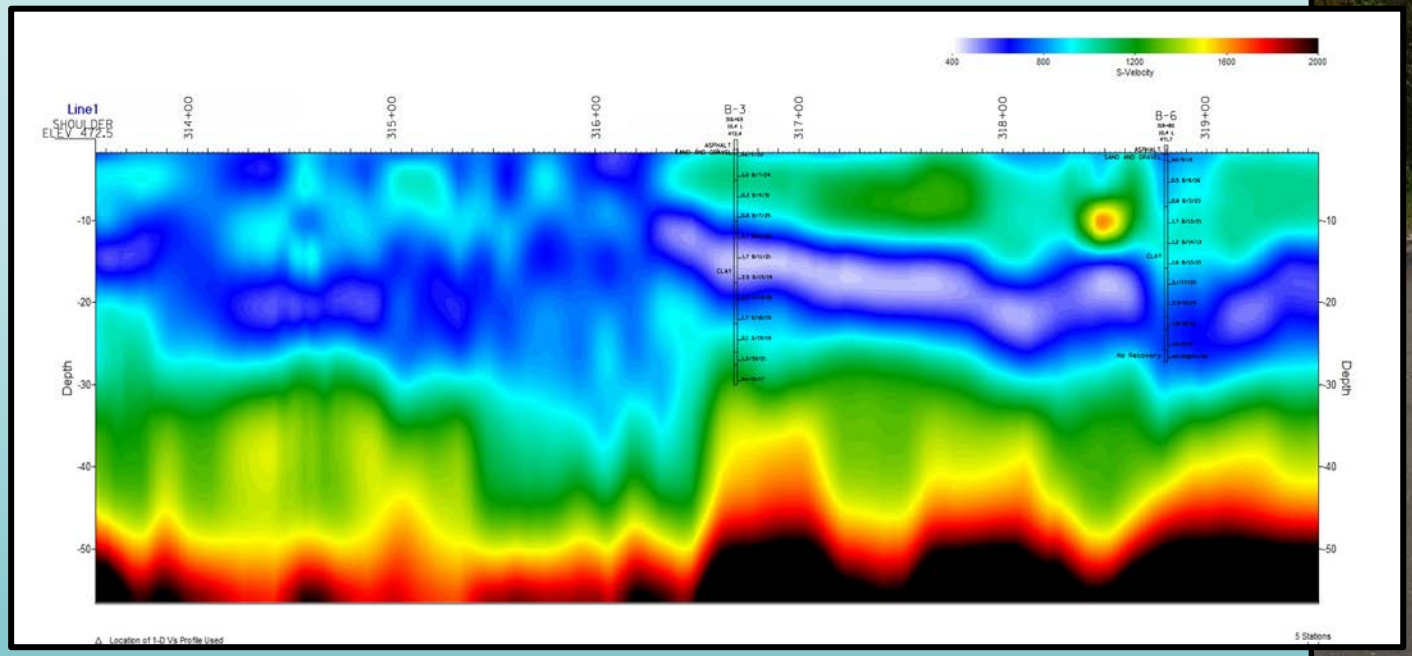


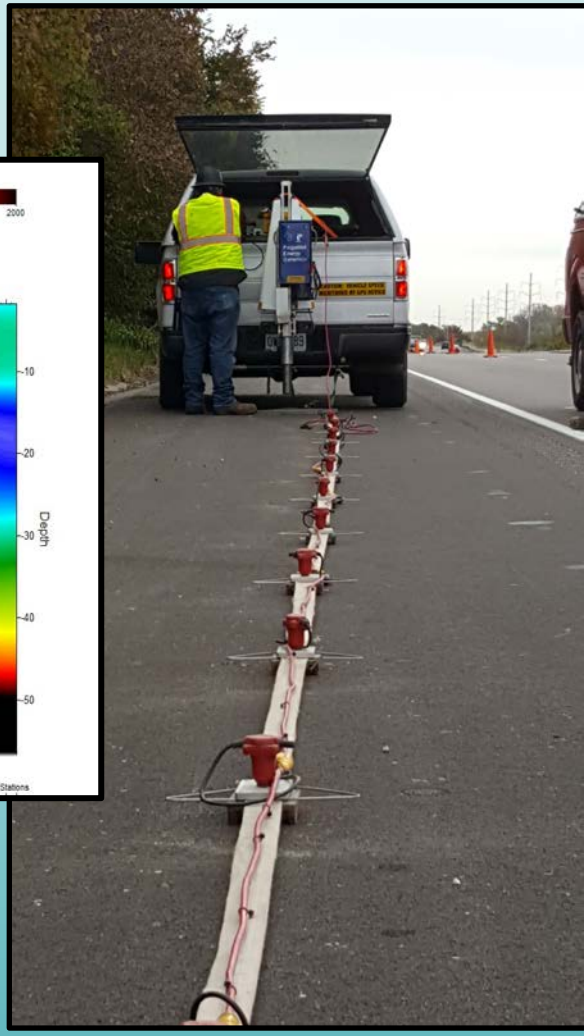




Seismic

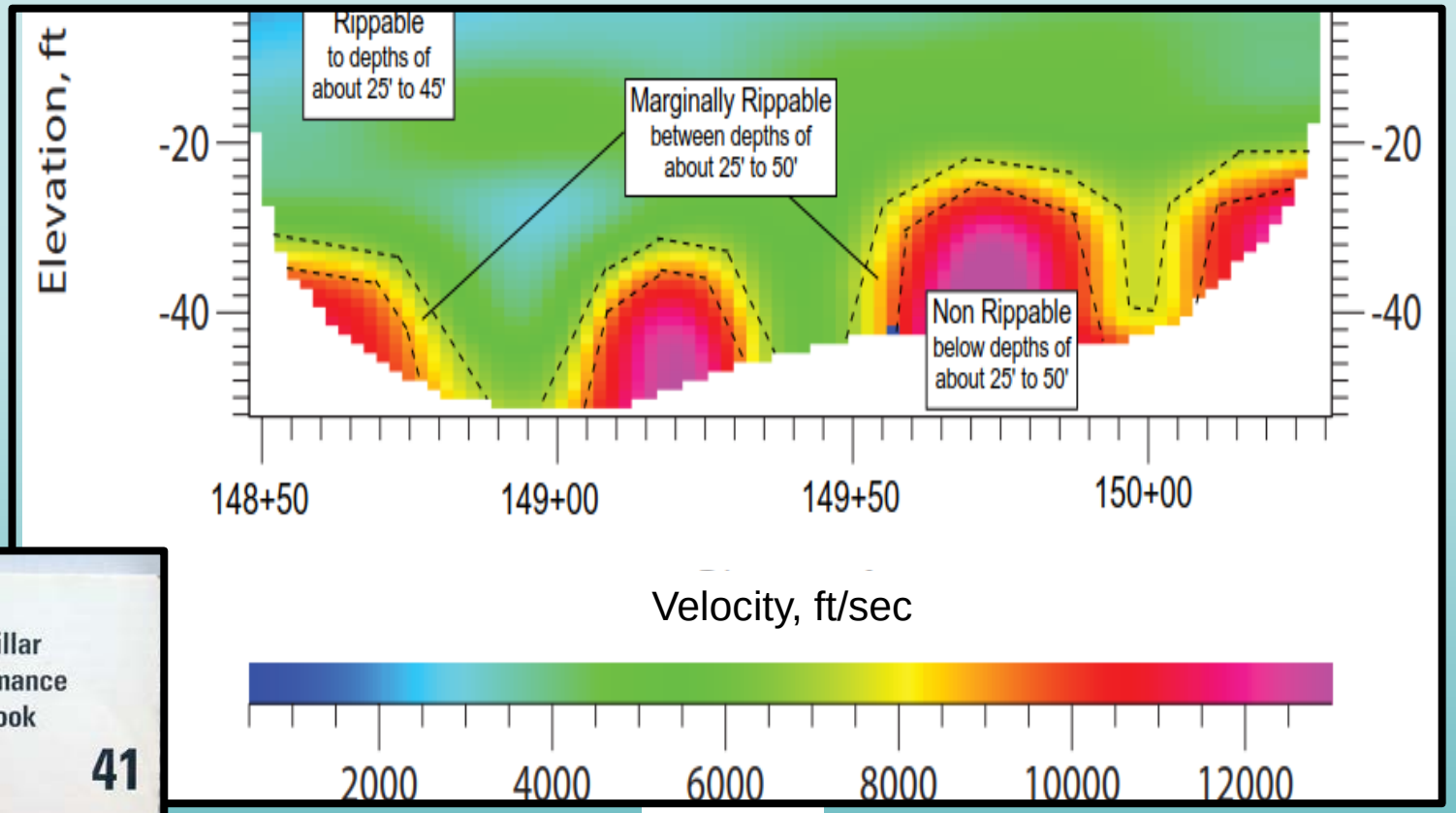
Mapping The Subsurface





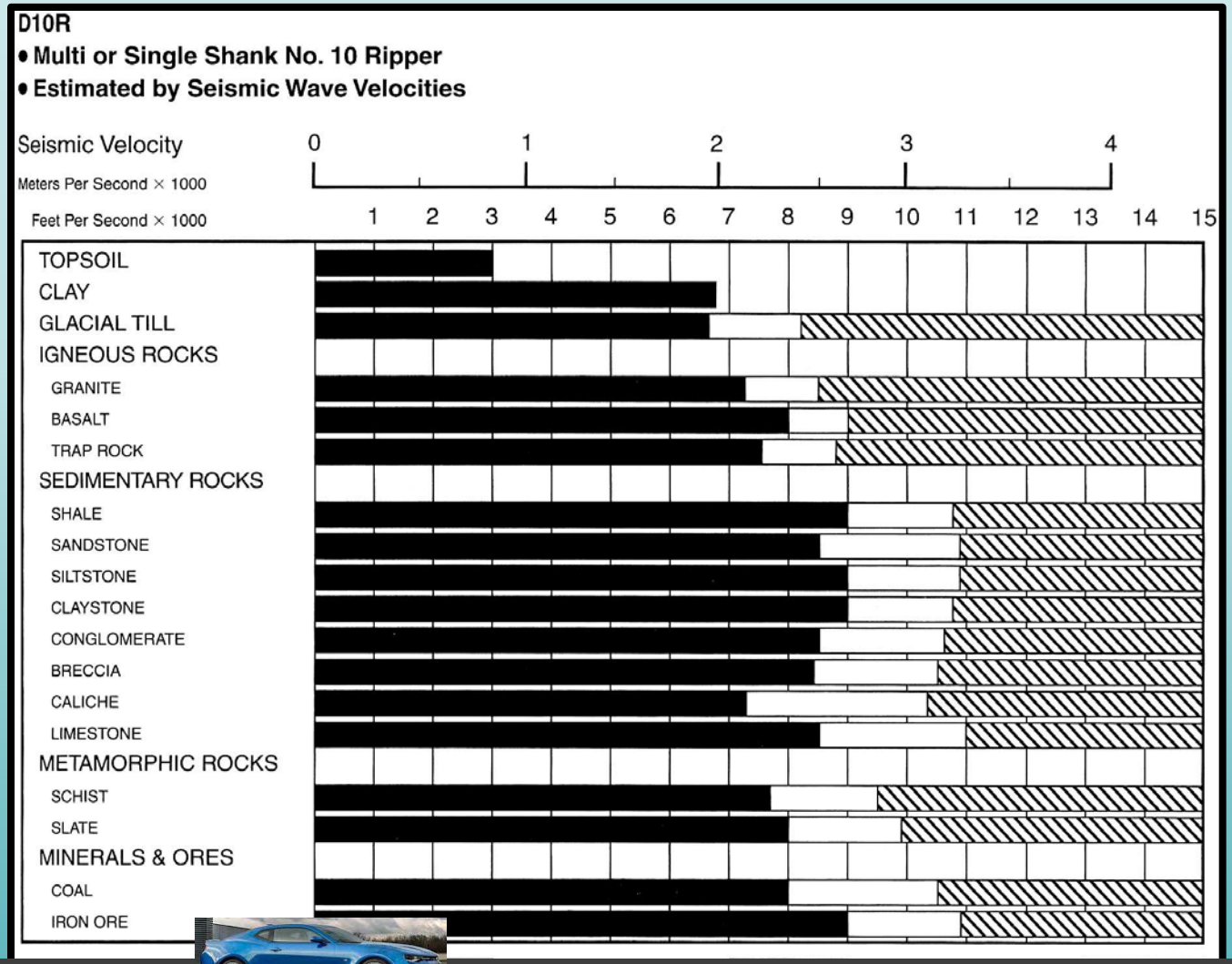
Seismic

Rippability Studies



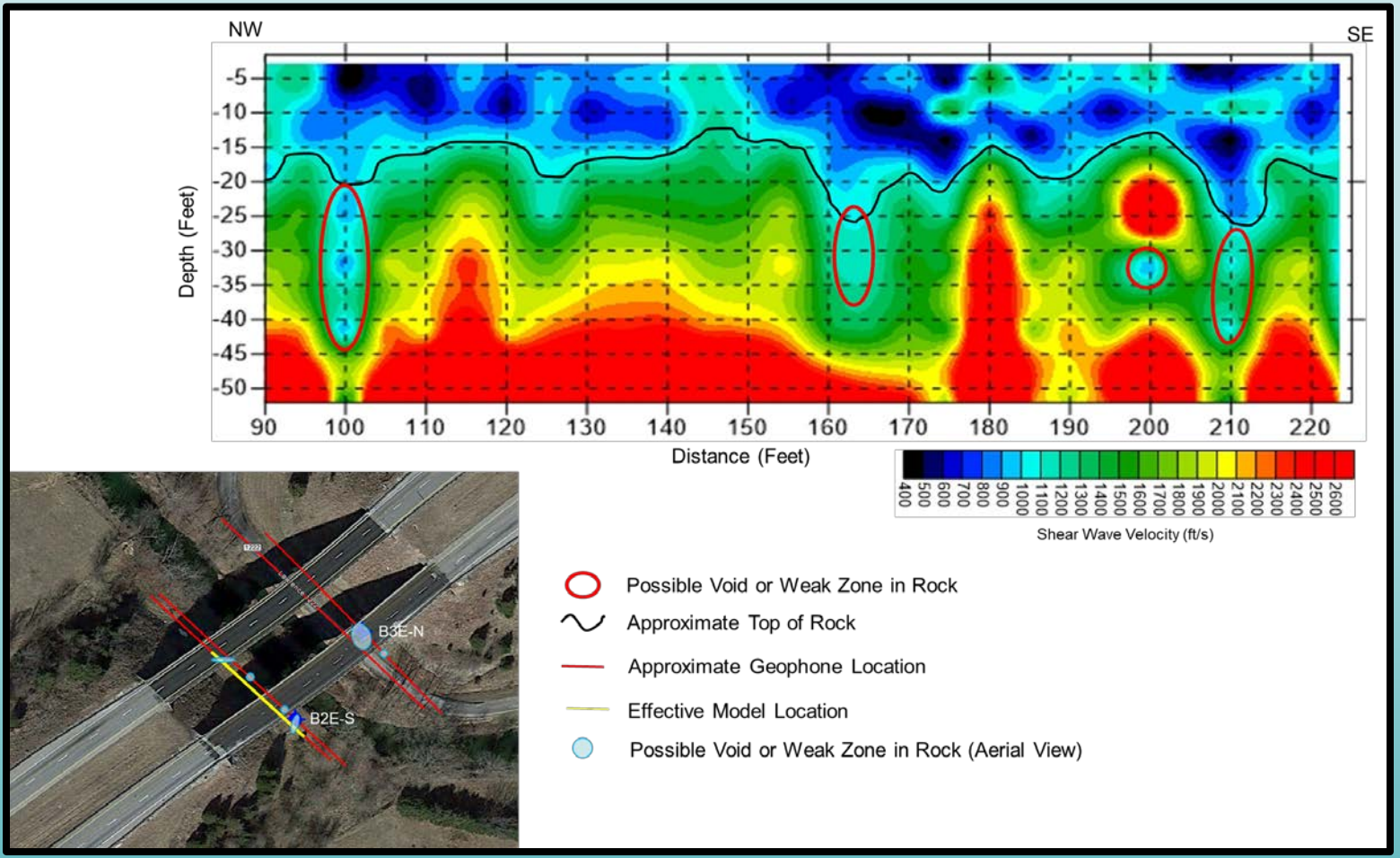
Seismic

Rippability Studies



Seismic

Locating Weak Zones/Karst

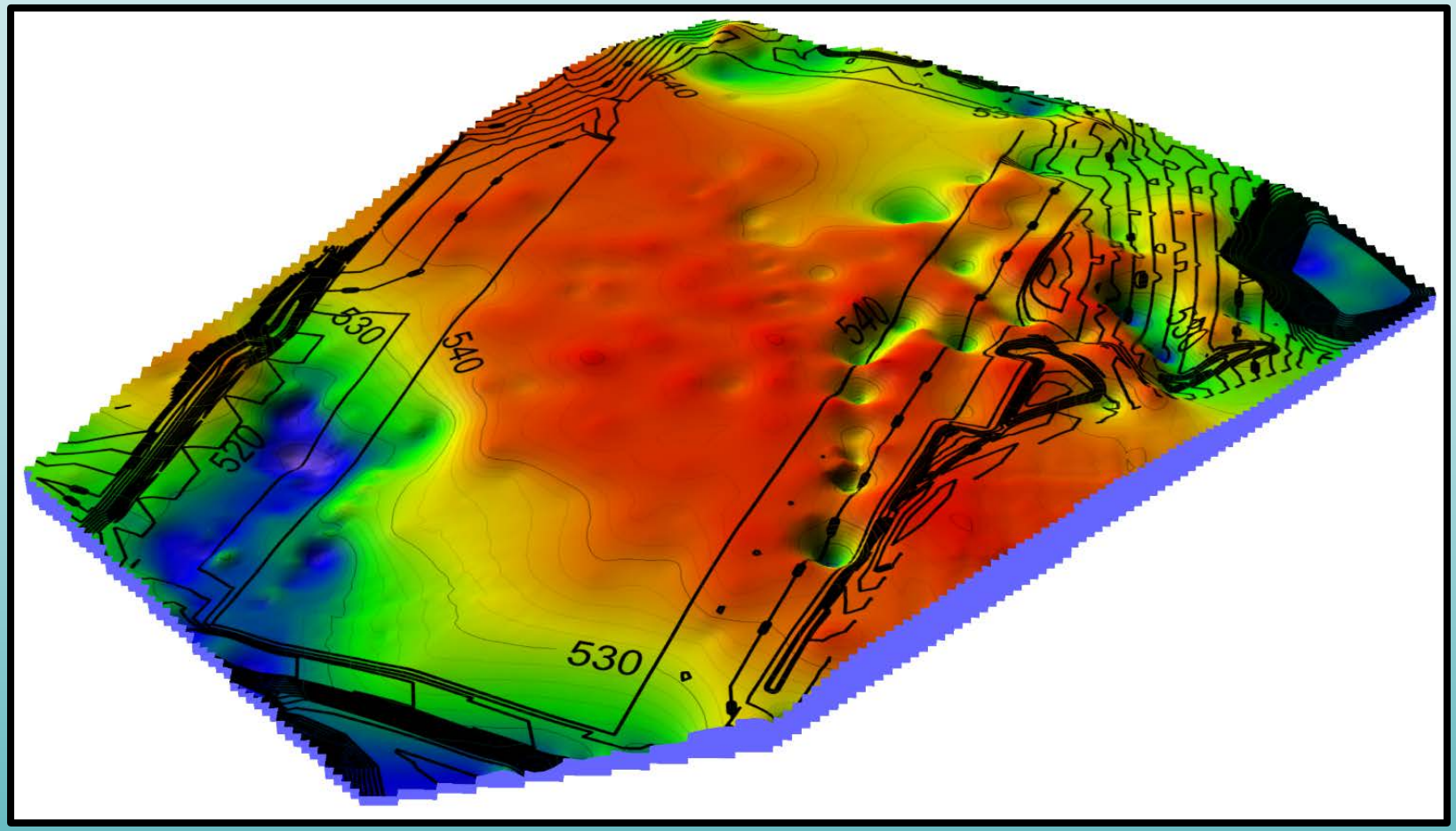


Electrical Resistivity Applications

- Map bedrock topography
- Detecting buried debris
- Locate potential sinkhole/karst conditions

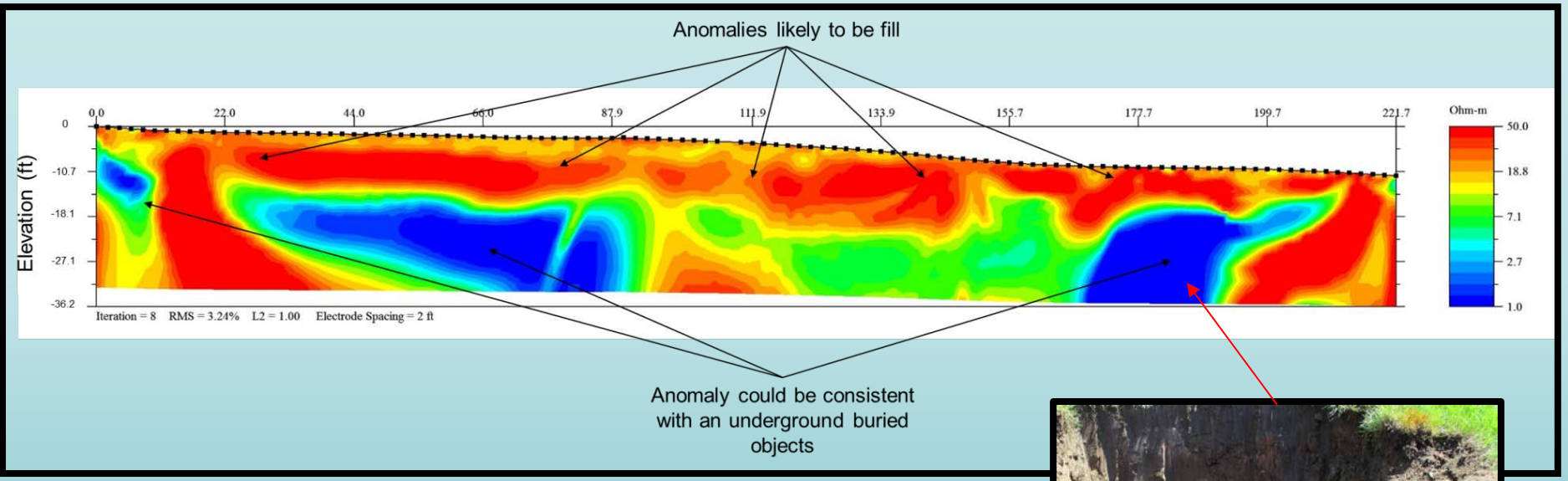
Electrical Resistivity Imaging

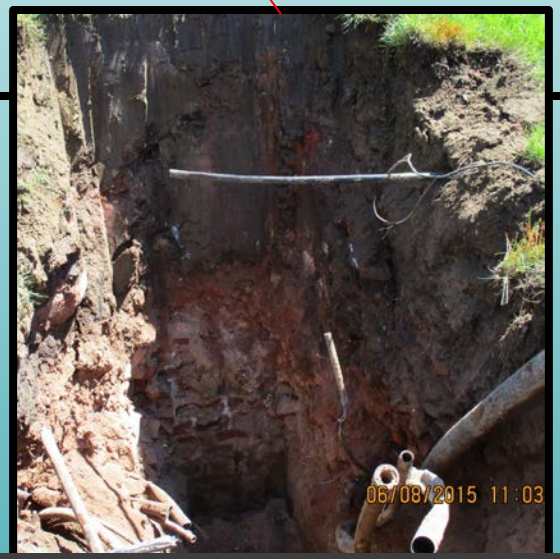
Mapping Bedrock Topography



Electrical Resistivity Imaging

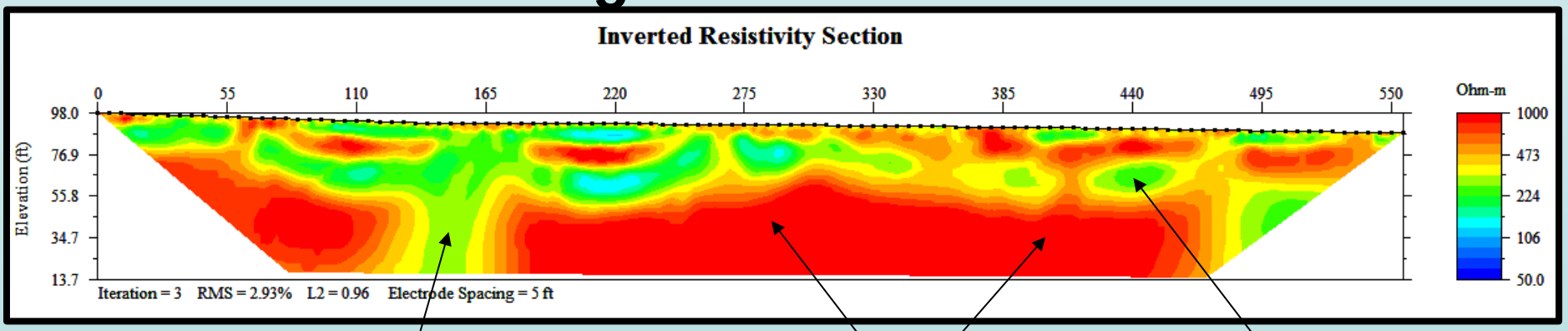
Detecting Buried Debris





Electrical Resistivity Imaging

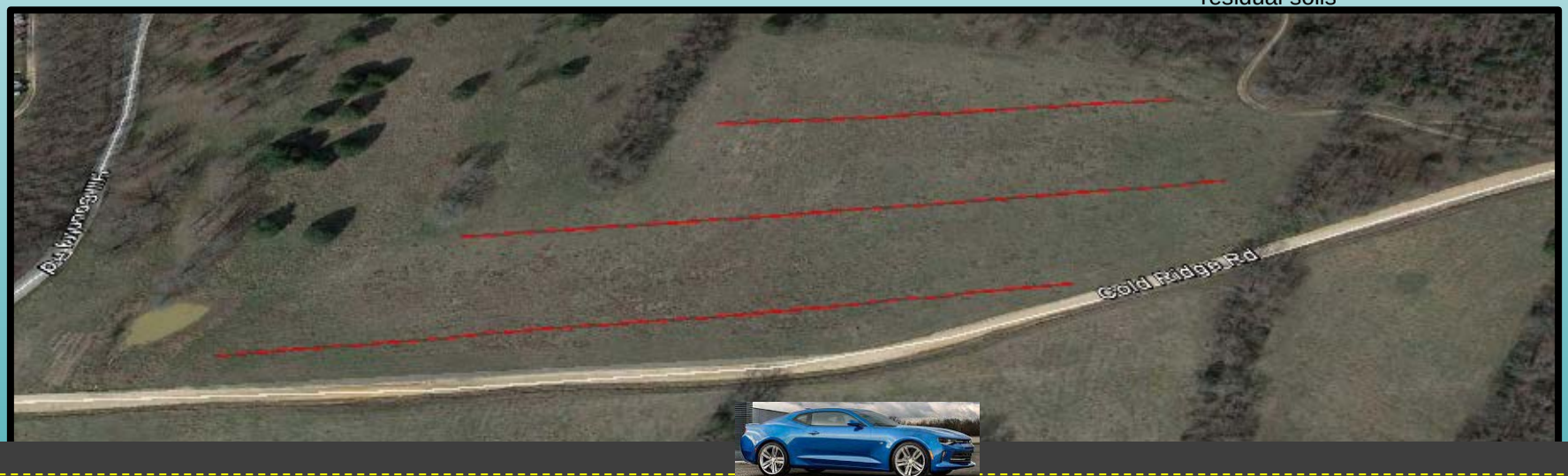
Locating Weak Zones/Karst



Anomalous area (light green, orange, and yellow) indicative of possible incipient sinkhole formation

Anomalous areas (red) indicative of intact bedrock

Anomalous areas (green) indicative of weathered bedrock or gravelly residual soils

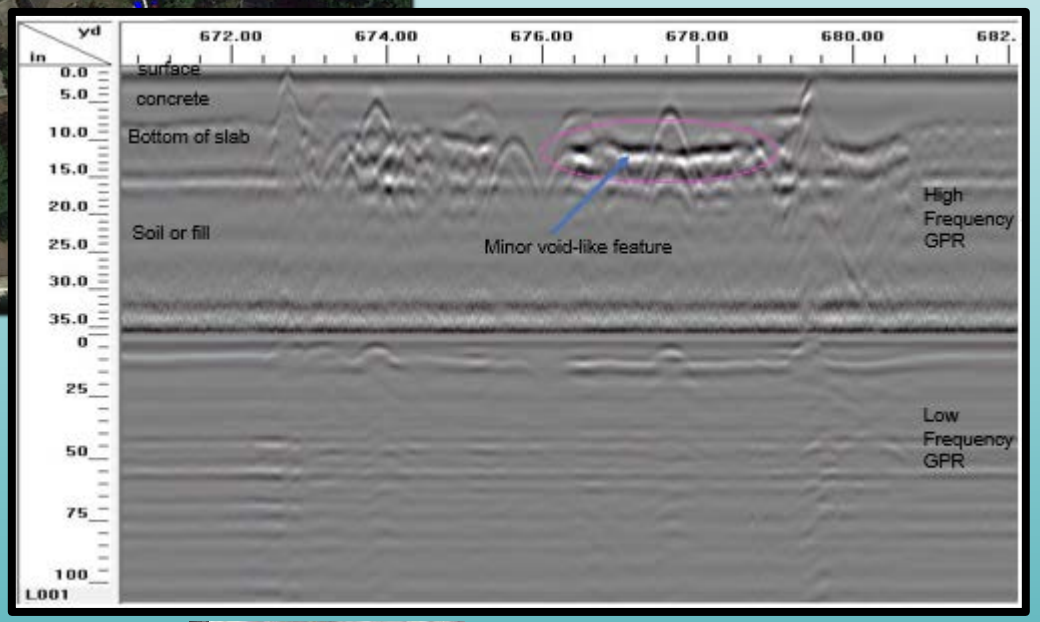


Ground Penetrating Radar Applications

- Detect shallow voids
- Locate buried debris/tanks/utilities
- Map shallow bedrock
- Determine reinforcement placement and pavement thickness

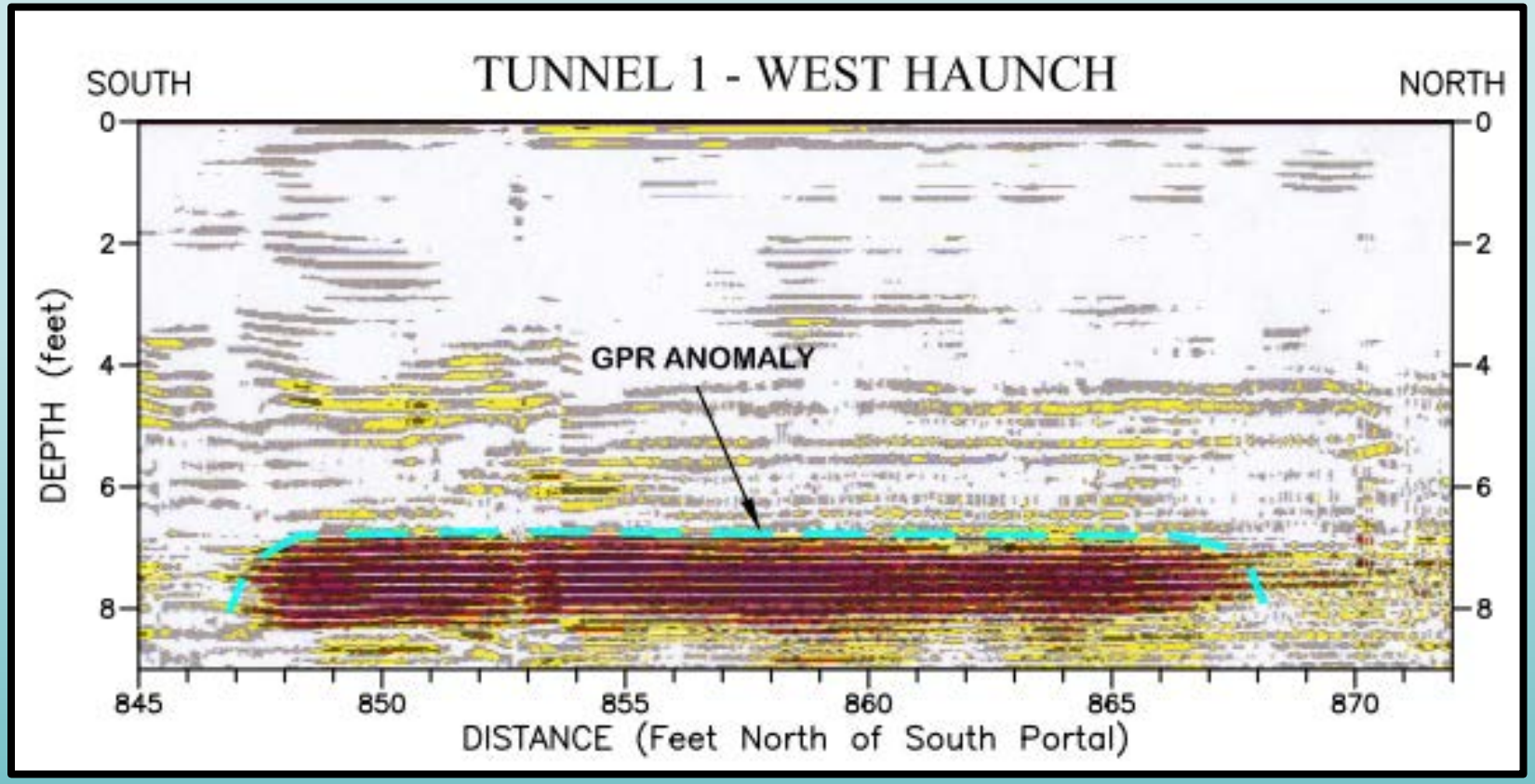
Ground Penetrating Radar

Void Detection



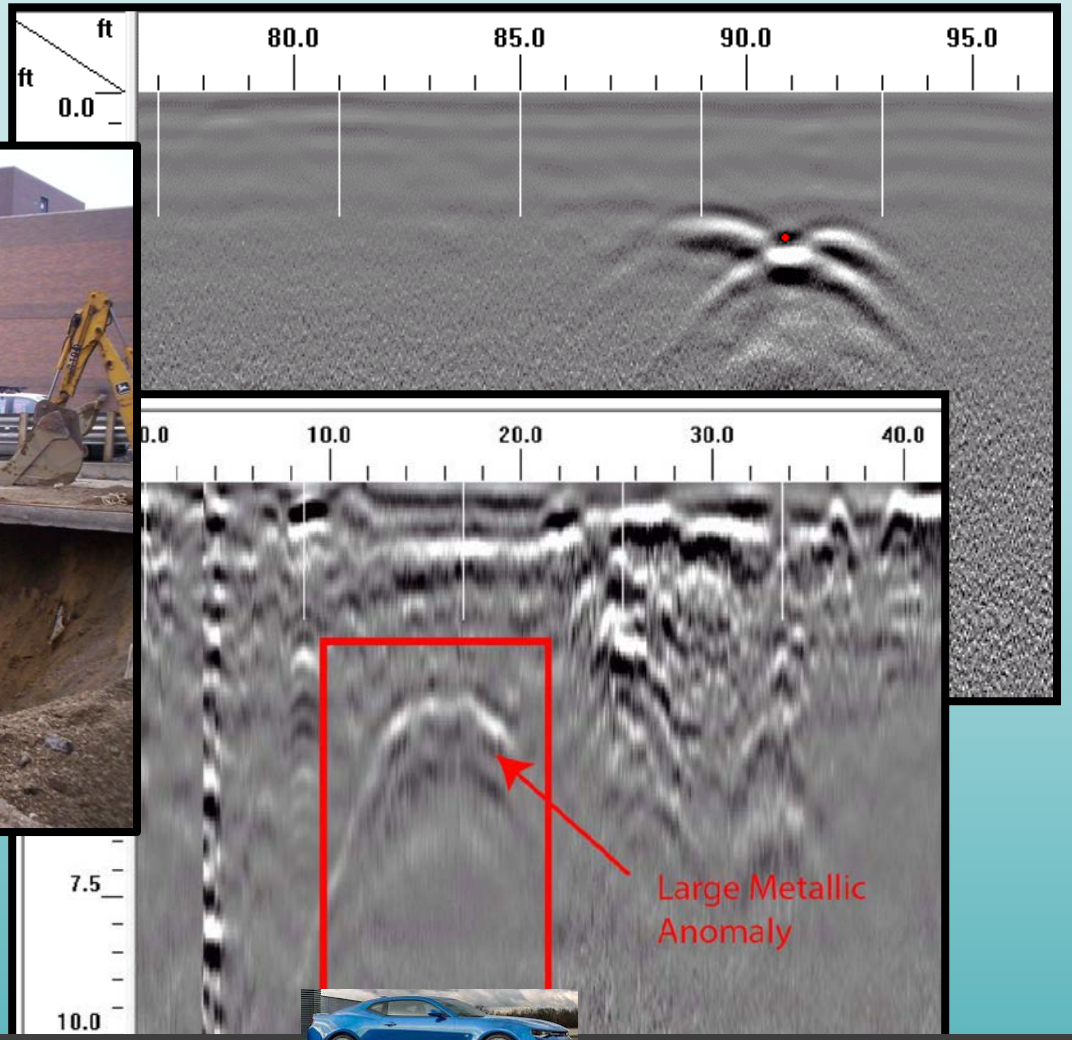
Ground Penetrating Radar

Void Detection



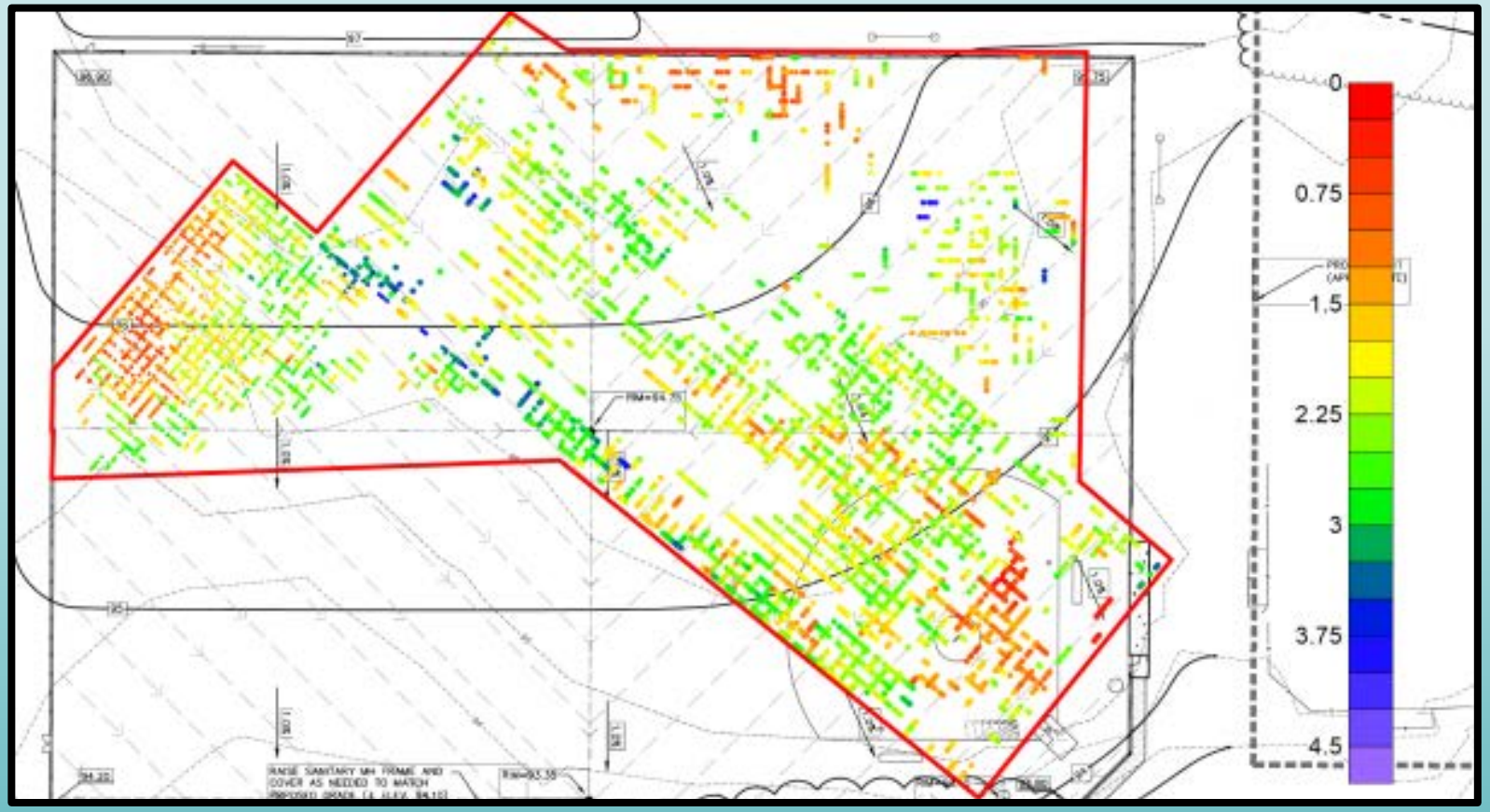
Ground Penetrating Radar

Locating Buried Debris



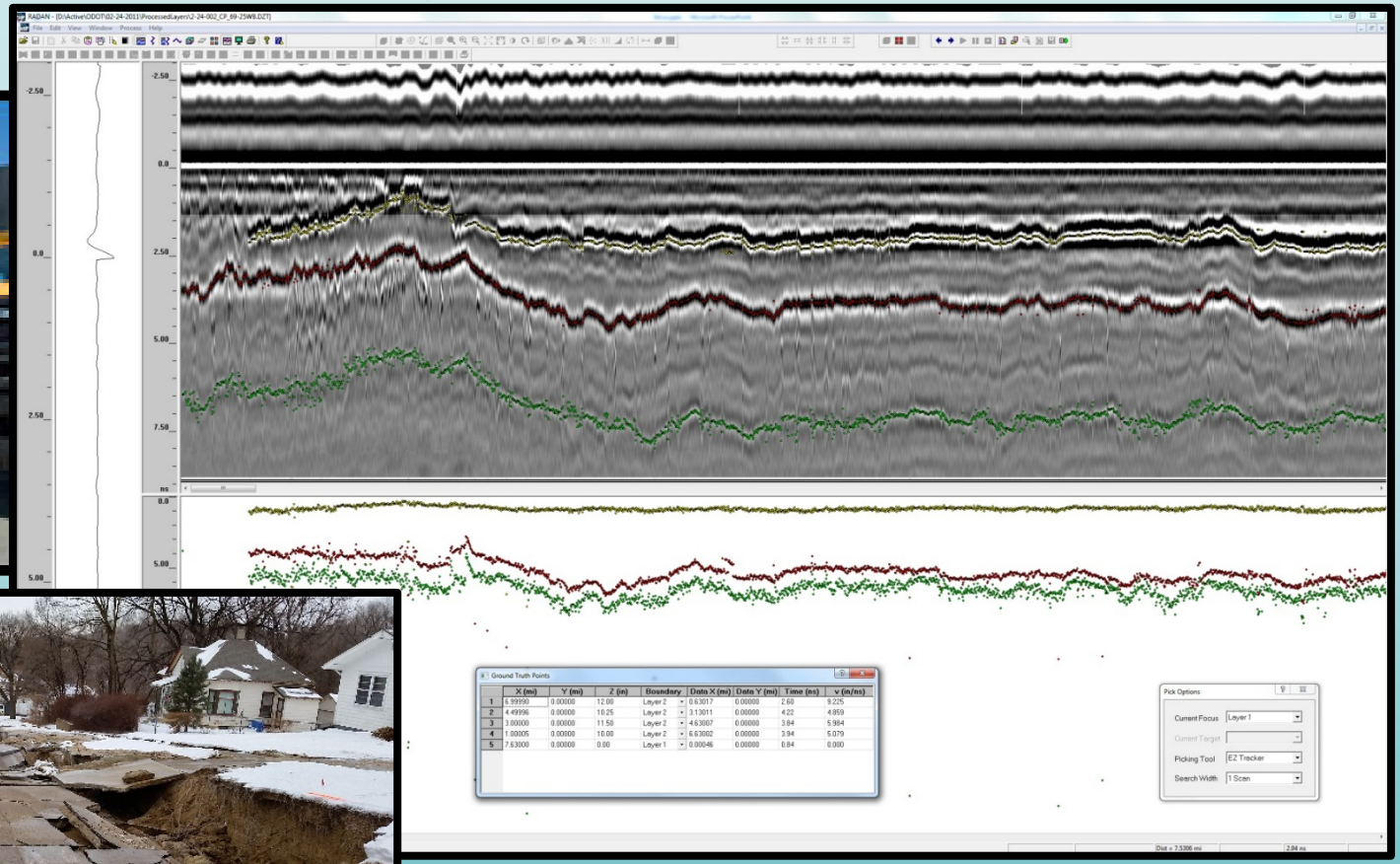
Ground Penetrating Radar

Mapping Shallow Bedrock



Ground Penetrating Radar

Evaluating Pavements

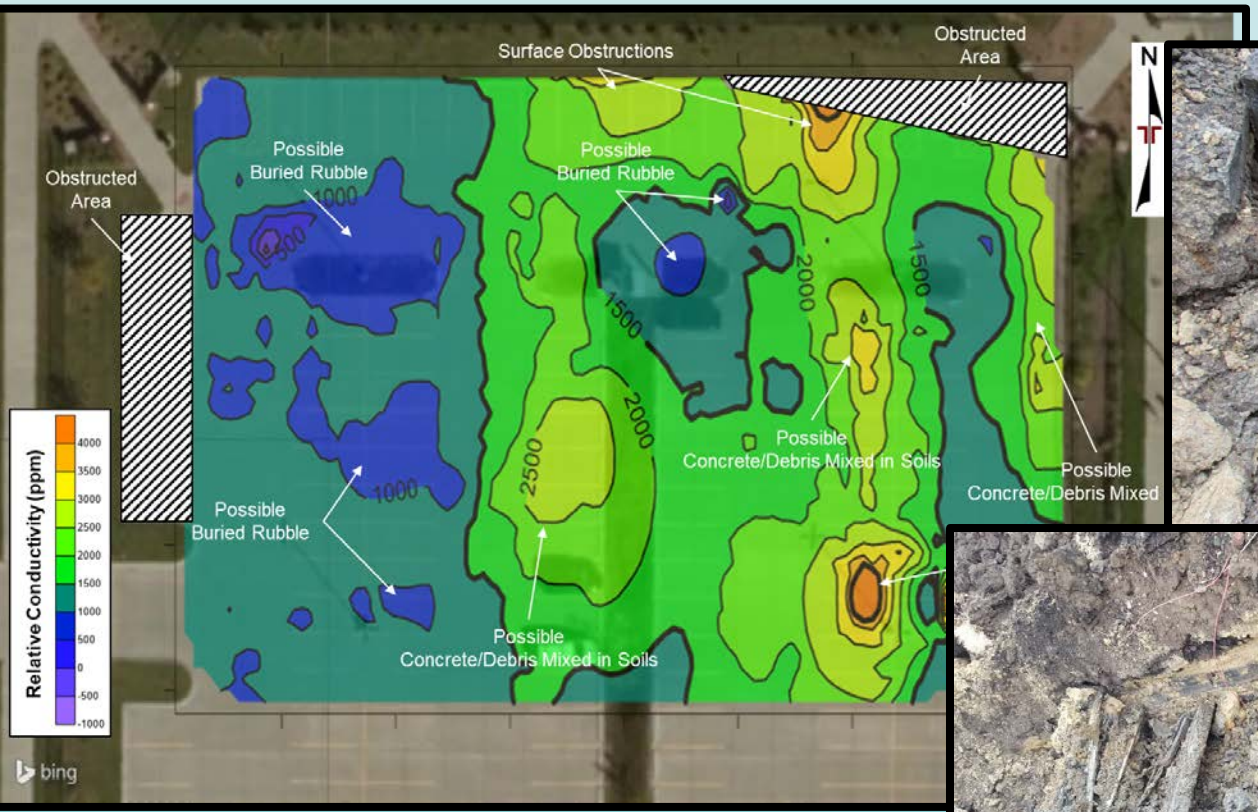


Electromagnetic Applications

- Locate buried debris/tanks/utilities
- Locate saturated/soft subsurface areas

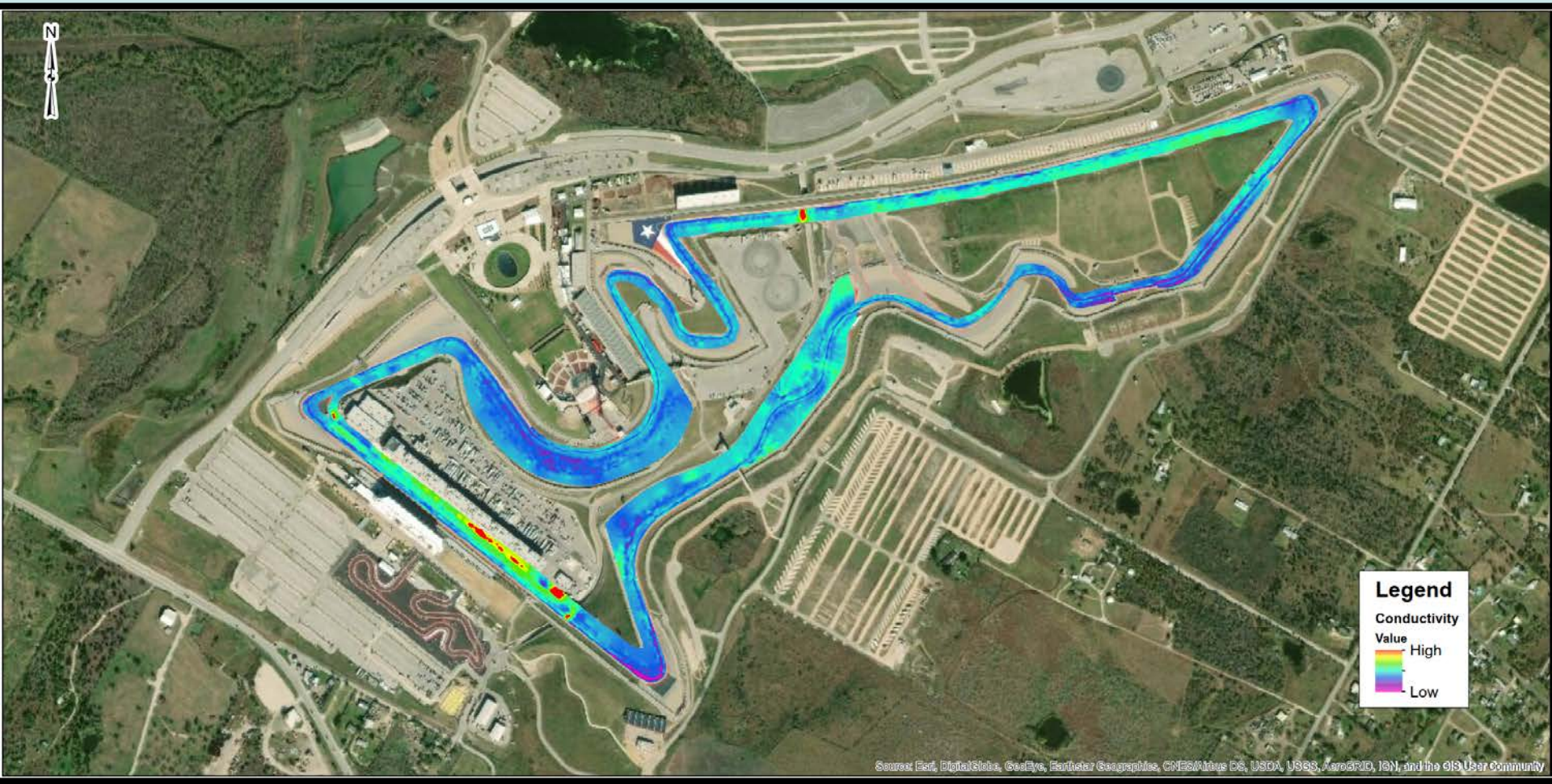
Electromagnetic

Locating Debris



Electromagnetic

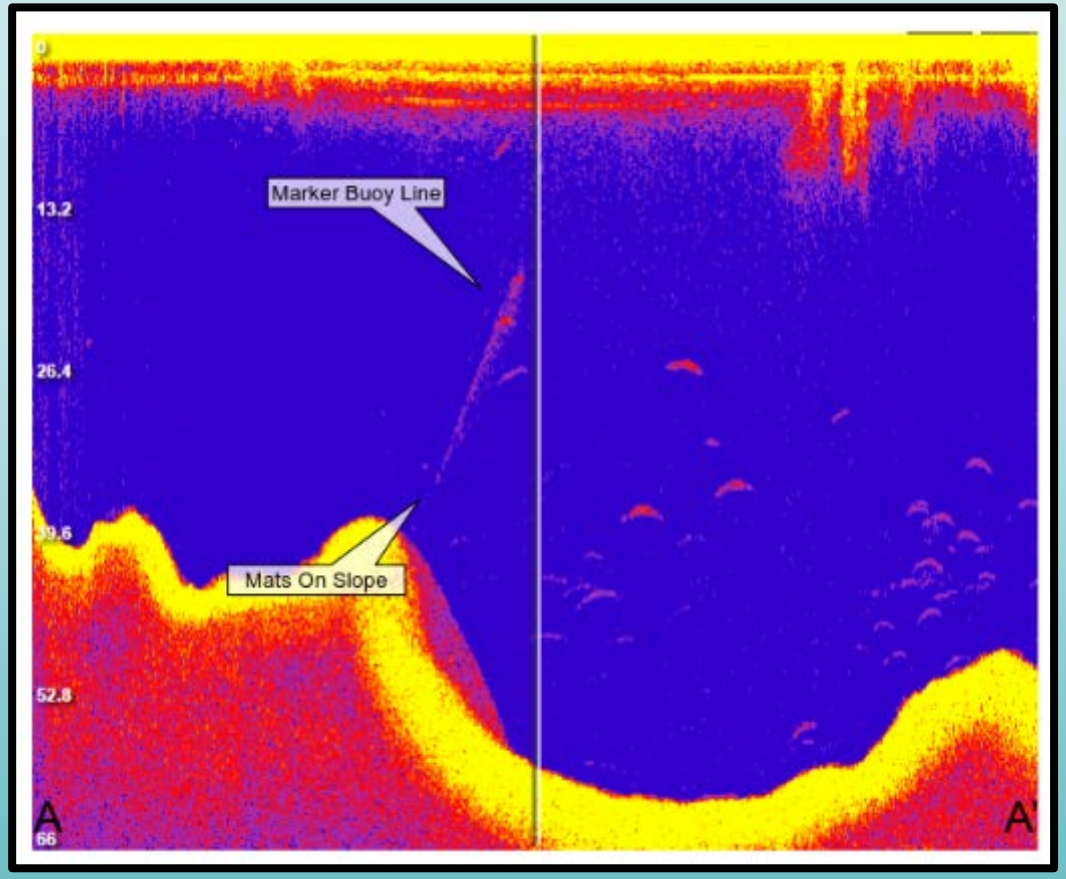
Locating Saturated/Soft Zones

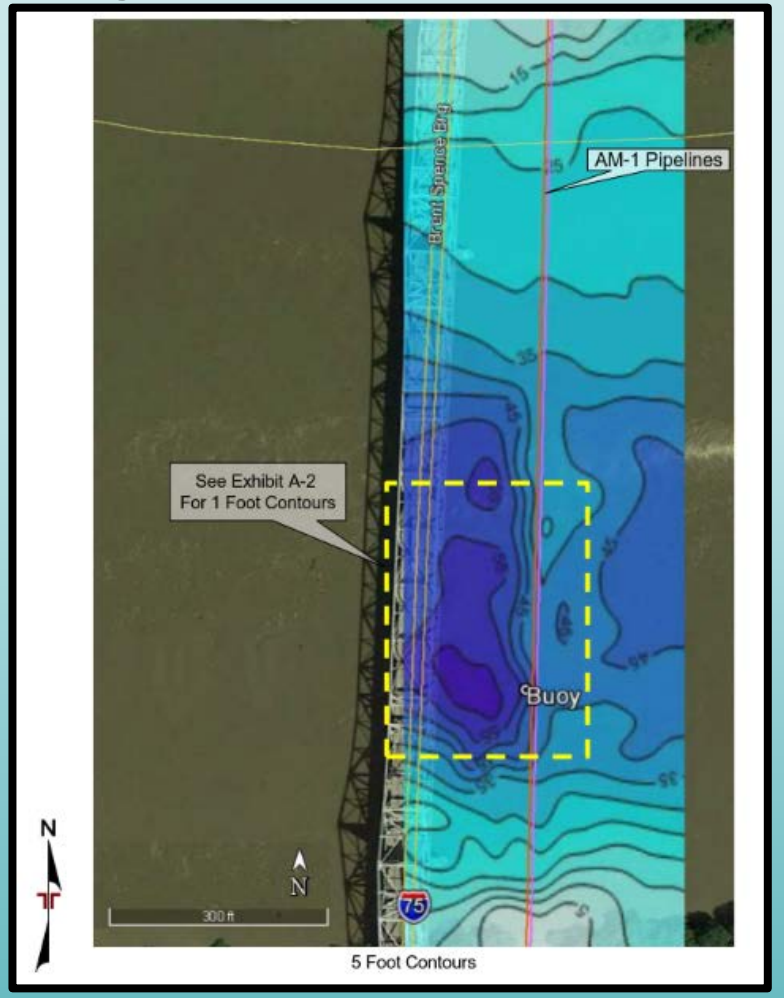


Just so the “Bridge Guys” Don’t Feel Left Out…

Marine Geophysics

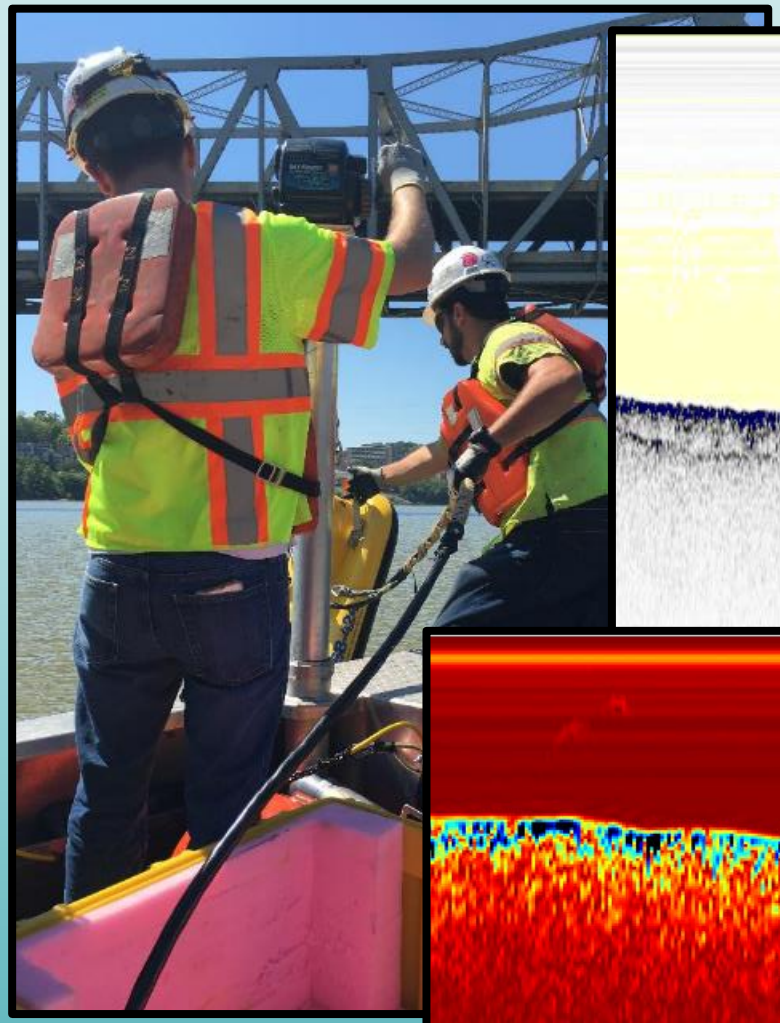
Echo Sounding

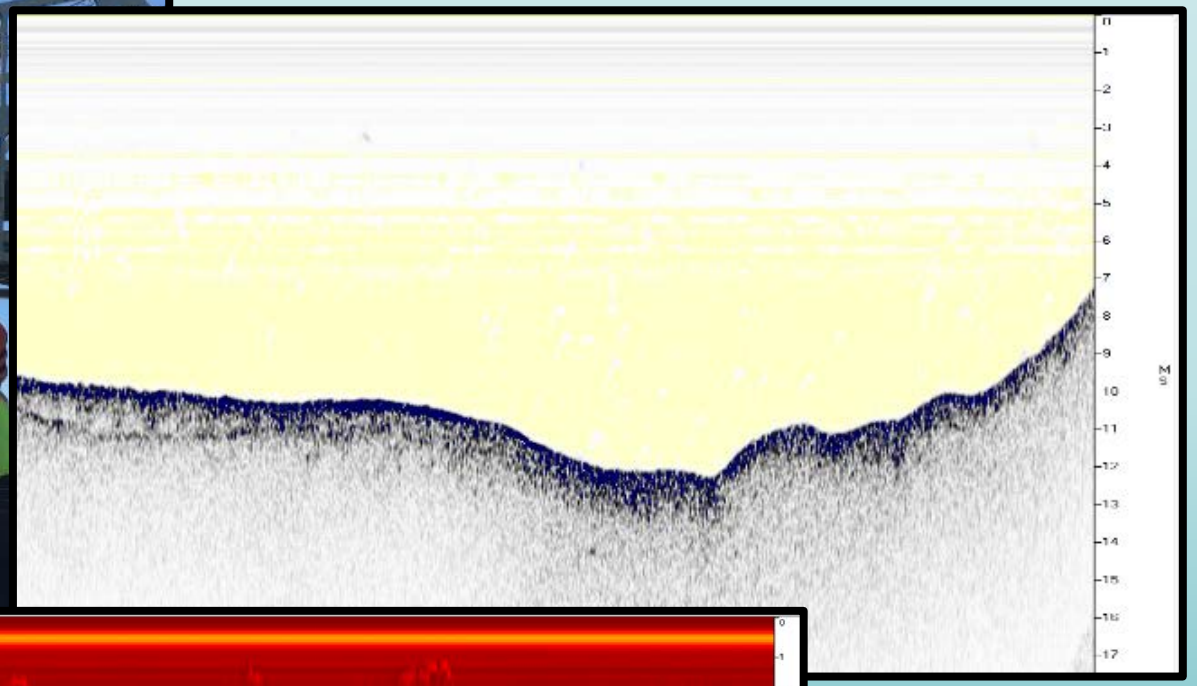


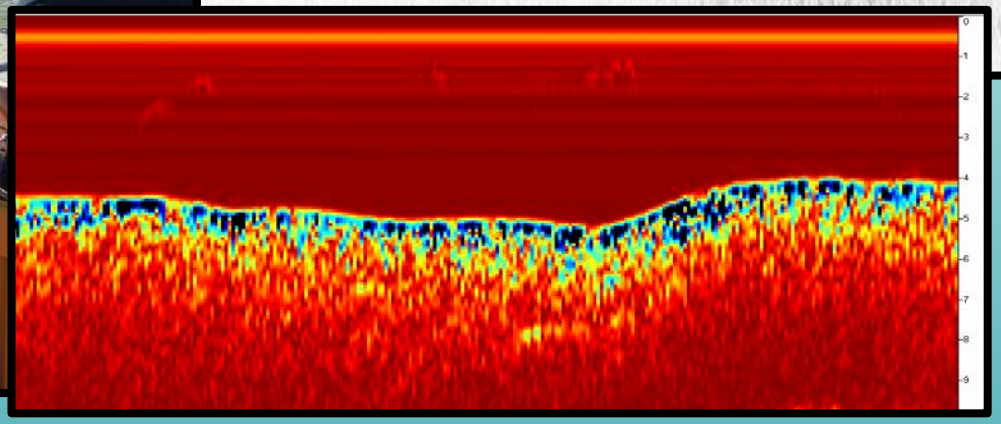


Marine Geophysics

Sub-bottom Profiling

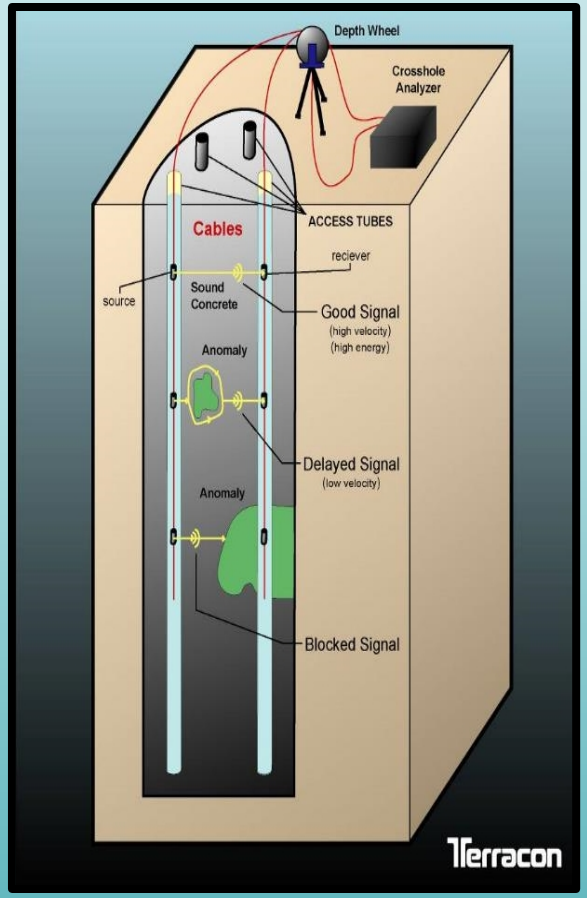


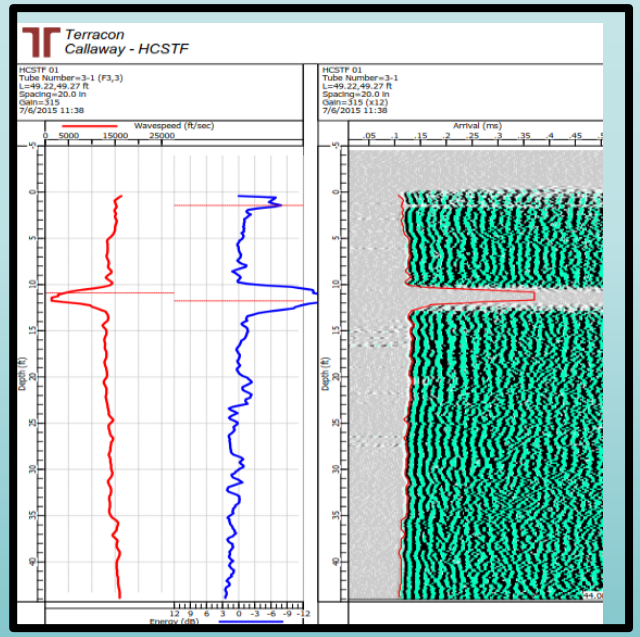




Drilled Shaft Testing Evaluation

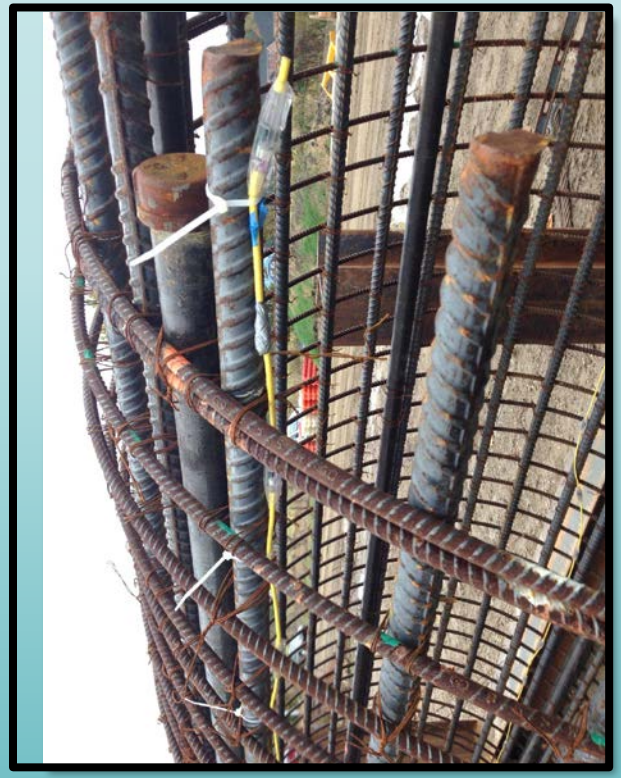
Cross-Hole Sonic Logging

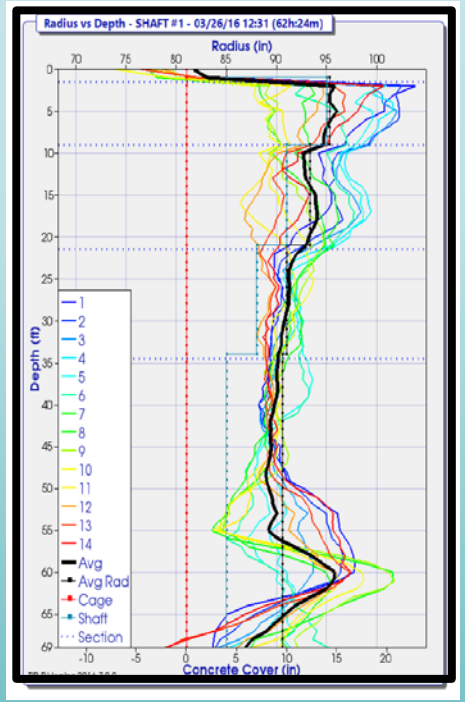


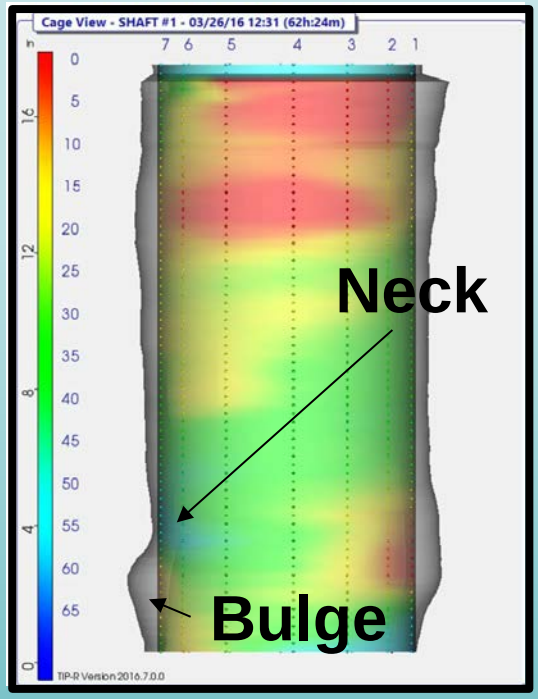


Drilled Shaft Testing Evaluation

Thermal Integrity Profiling







Think Geophysics