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APPLIED GEOPHYSICS FOR TRANSPORTATION AND INFRASTRUCTURE PROJECTS IN THE SOUTHEAST

What Is NDT / Geophysics

The study of the Earth and other materials using measurements of physical properties:

- Dielectric Constant (GPR)
- Shear Wave Velocity (Seismic, Acoustic NDT)
- Compressional Wave Velocity (Seismic, Acoustic NDT)
- Resistivity (ERT)
- Conductivity (EM)
- Distortions in Earth's Magnetic and Gravitational Fields

Why Use NDT / Geophysics?

- Non- or Minimally Invasive
- Provide Data in Hard to Access Areas
- Reduce Costs
- Fill Data Gaps
- Improve Physical Sampling Efficacy

Geophysical investigations are best employed in conjunction with traditional exploration and testing methods.

Geophysical Methods

Seismic Refraction Tomography (SRT)

- Compressional Wave Velocity (P-Wave)

Multi-Channel Analysis of Surface Waves (MASW)

- Shear Wave Velocity (S-Wave)

Electrical Resistivity Tomography (ERT)

- Electrical Resistance

Ground Penetrating Radar (GPR)

- Dielectric Constant

Electro Magnetics (EM)

- Electrical Conductivity

Geophysical Applications

- **Seismic Refraction Tomography (SRT)**
  Top of Rock, Rippability, Stratigraphy

- **Multi-Channel Analysis of Surface Waves (MASW)**
  Seismic Site Classification, Shear Wave Velocity Soundings and Cross-Sections

- **Ground Penetrating Radar (GPR)**
  Utility Mapping, Stratigraphy, USTs, Voids, Landfill Delineation, Locate Buried Objects

- **Electrical Resistivity Tomography (ERT)**
  Groundwater, Karst, Stratigraphy, Contaminant Plum, Landfill Delineation, Dam/Levee Evaluation, Grounding Grid Design, Liner Leak Locate

- **Electro-Magnetics (EM)**
  Utility Mapping, USTs, Landfill Delineation, Locate Conductive Objects/Debris

- **Borehole Geophysics**
  Evaluation of Deep Foundation Elements, P-Wave and S-Wave Velocity Profiles, Optical/Acoustical Televiewer

Non-Destructive Testing
Foundations & Concrete Structures

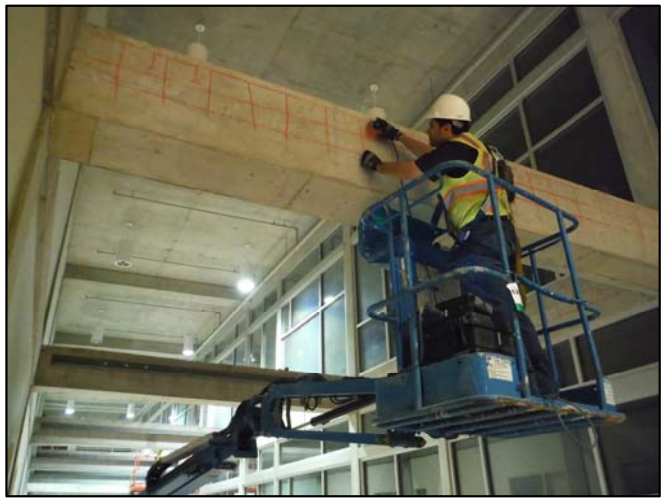
METHODOLOGIES

- Sonic Echo / Impulse Response (SE/IR)
- Impact Echo (IE)
- Parallel Seismic
- Ground Penetrating Radar (GPR)
- Ultra-Sonic Pulse Velocity (UPV)
- Spectral Analysis of Surface Waves (SASW)

Non-Destructive Testing
Foundations & Concrete Structures

APPLICATIONS

- Forensic Investigations
- Rebar Mapping
- Unknown Foundations
- Wood Poles
- Voids Under Slab
- Cracked Concrete
- Locate Objects Embedded in Concrete (cables, plates, etc.)
- Building Envelope Investigations
- Concrete Defects (honey combing, delaminations etc.)

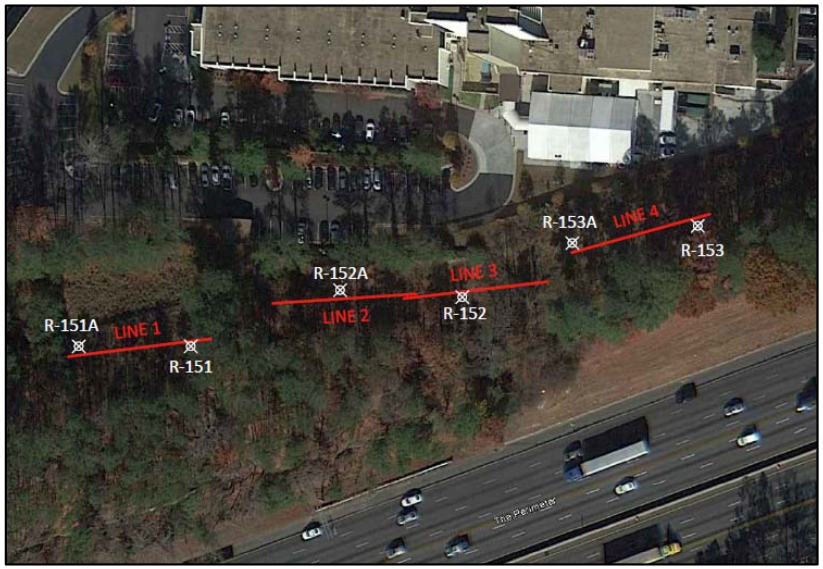


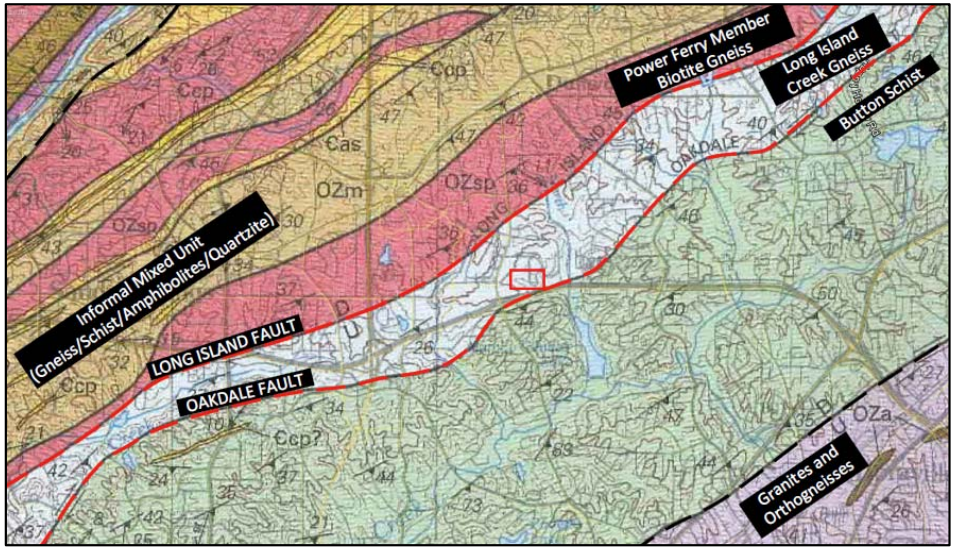
Investigation Types

1. **Geophysics for Transportation**
   - Roadway Widening/Improvements
   - Wall Design
   - Landslide
2. **NDT for Existing Structures**
   - Unknown Foundations/Structures
   - Forensic Investigation of Existing Foundations/Structures
   - QA for Concrete Structures

GEOPHYSICS FOR TRANSPORTATION

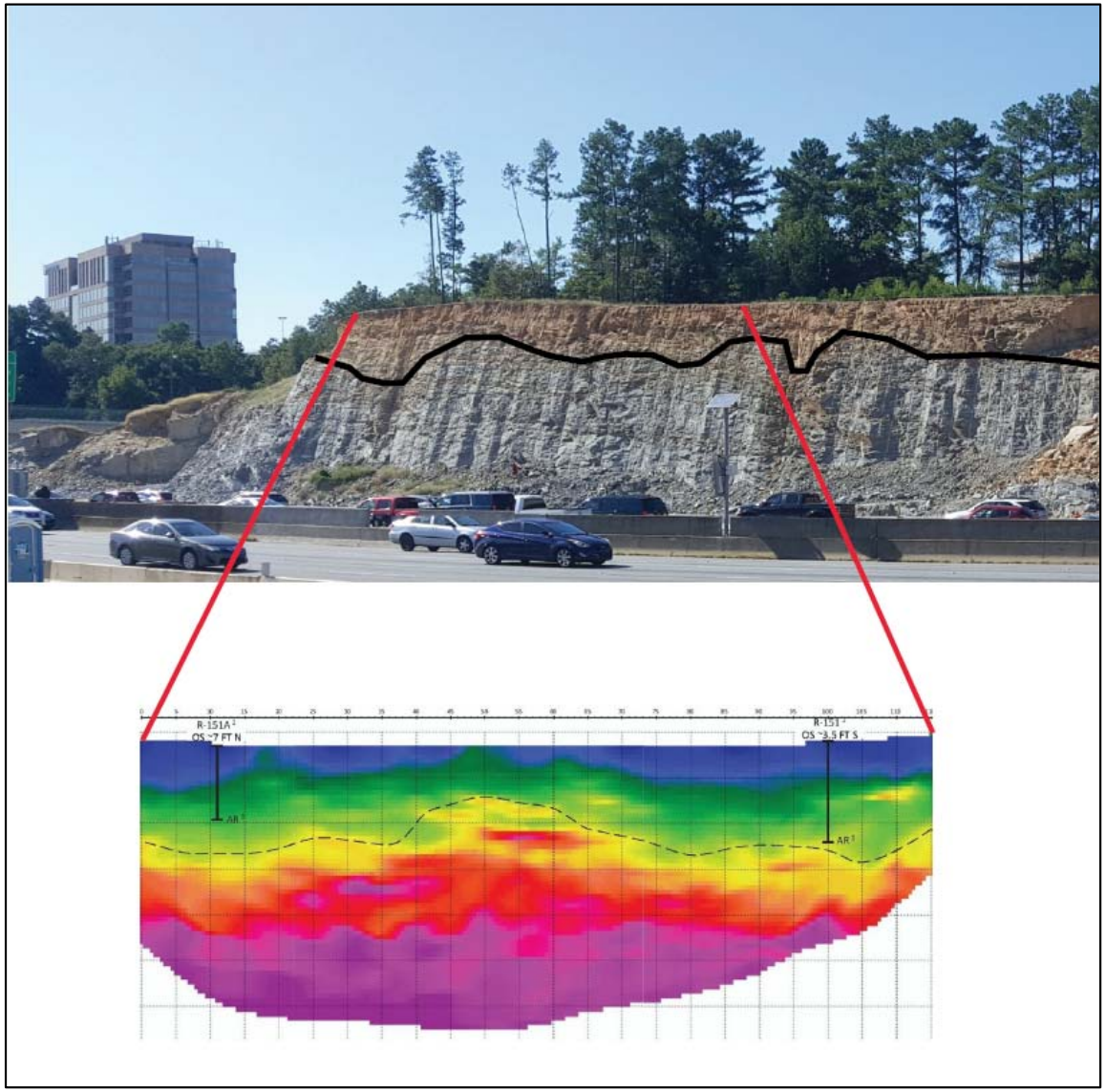
Seismic Refraction Tomography



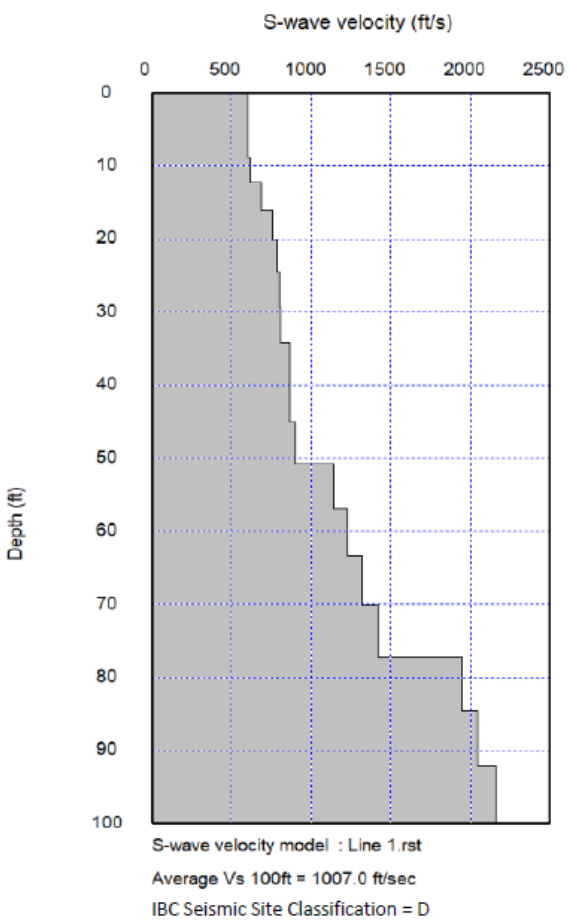


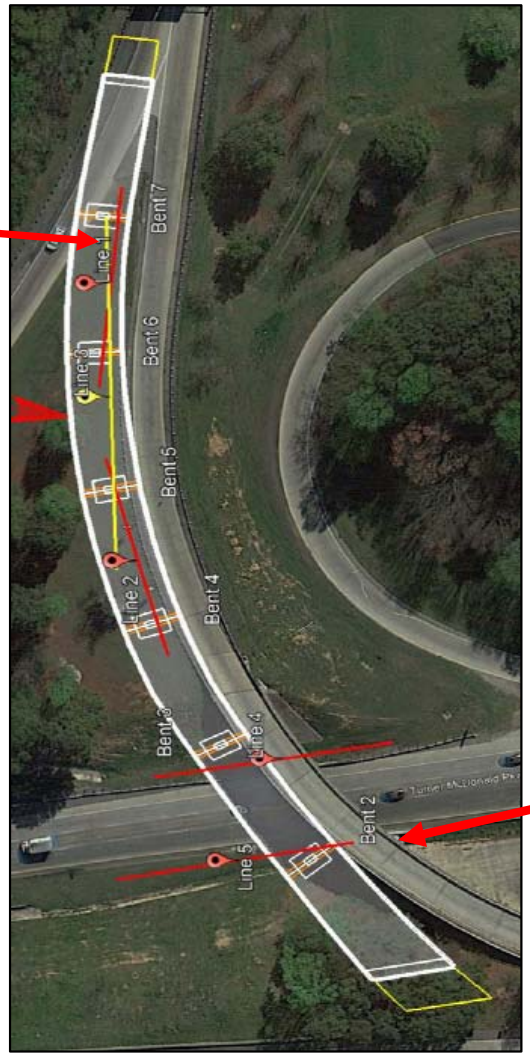
- Very Noisy Site
- Multiple Sources of Seismic Noise
- Variable Depth to Top of Rock

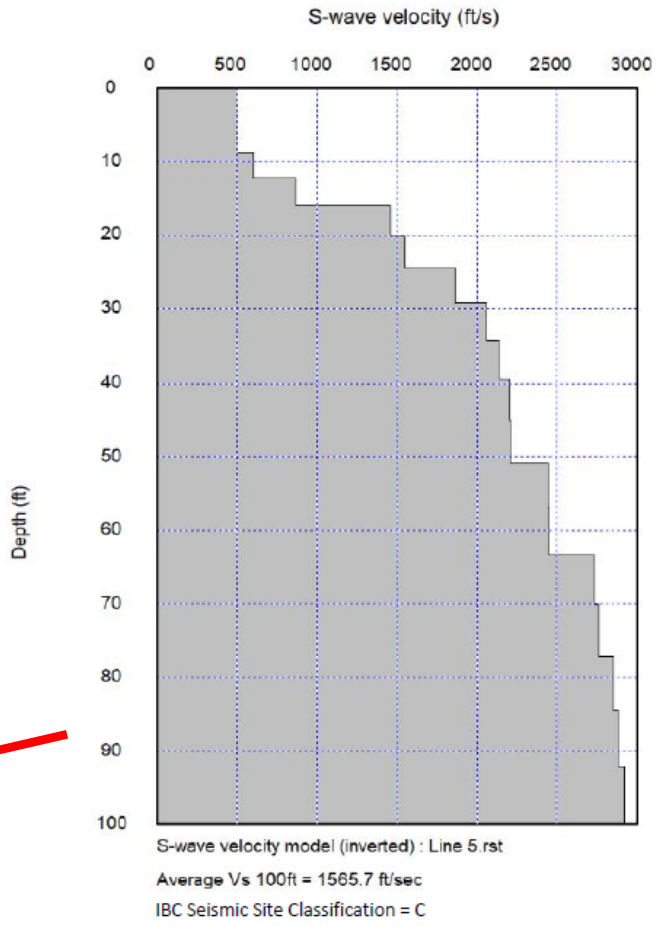
Seismic Refraction Tomography



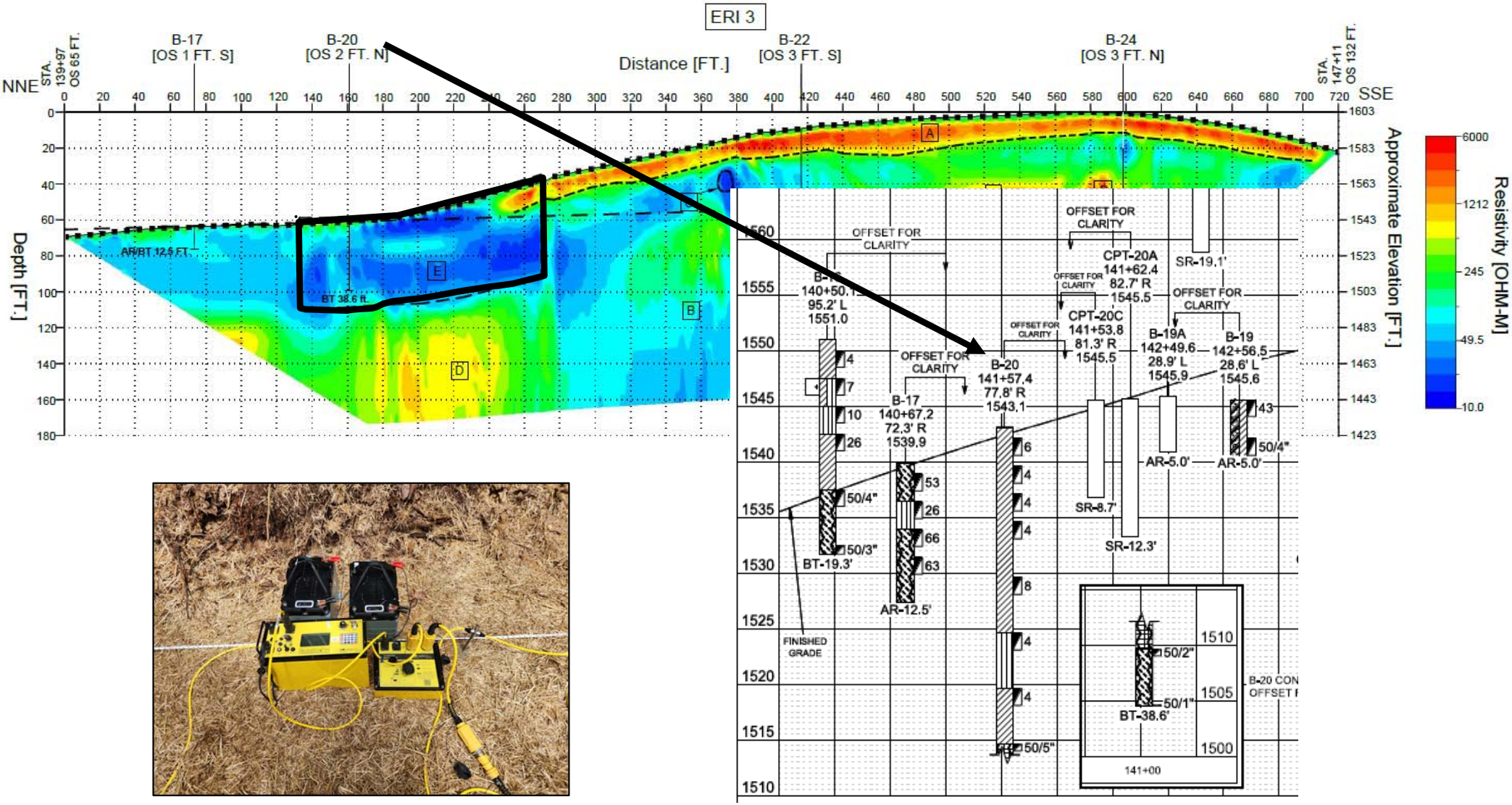
MASW To Improve Site Seismic Classification







Roadway Widening



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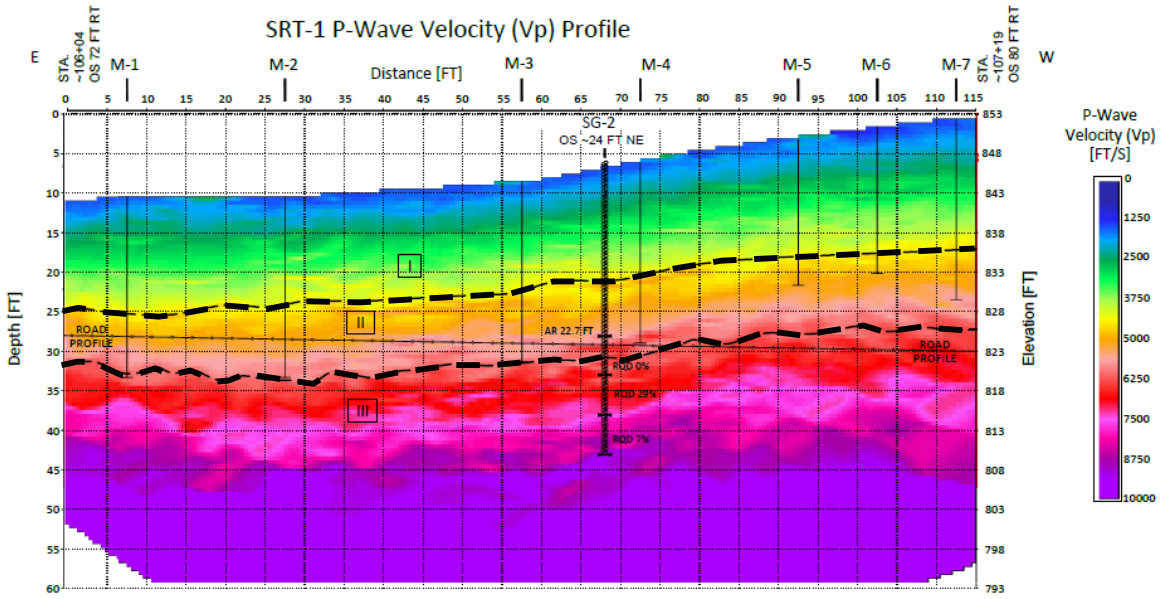

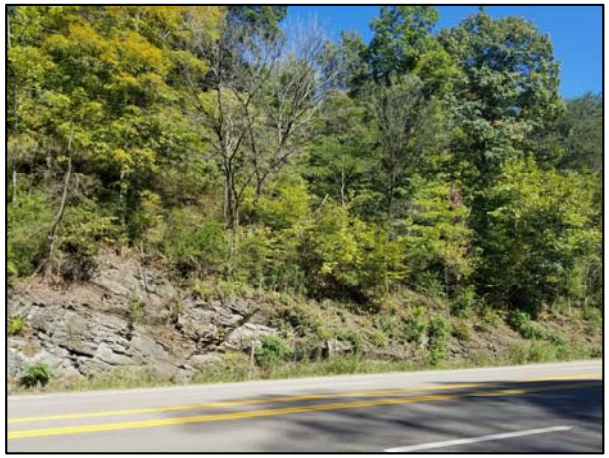

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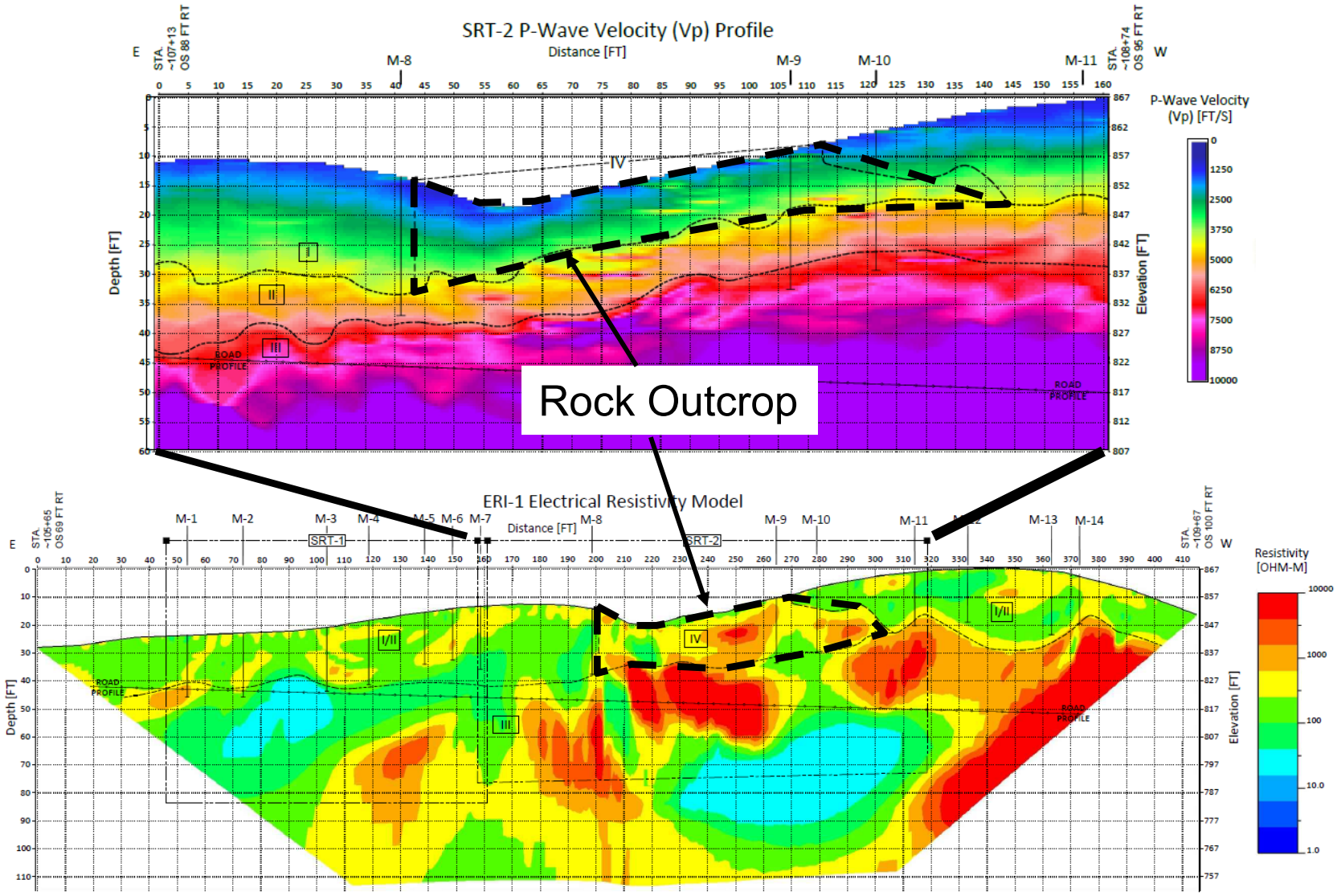
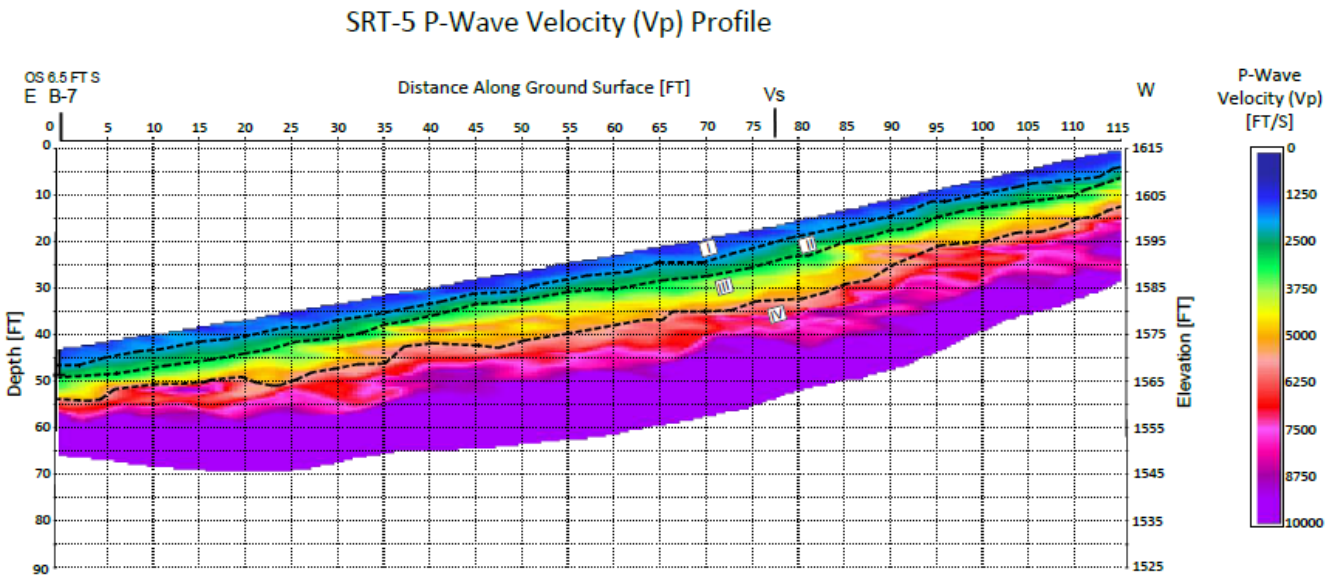


Landslide – Limited Access



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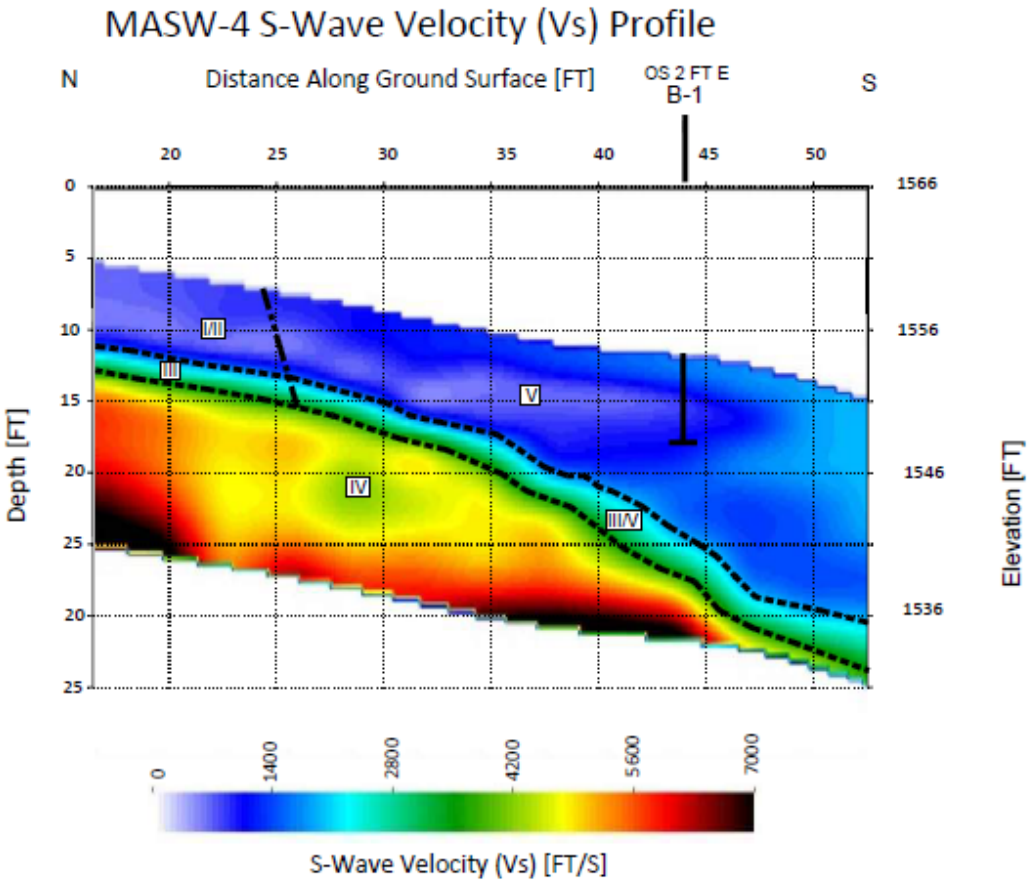
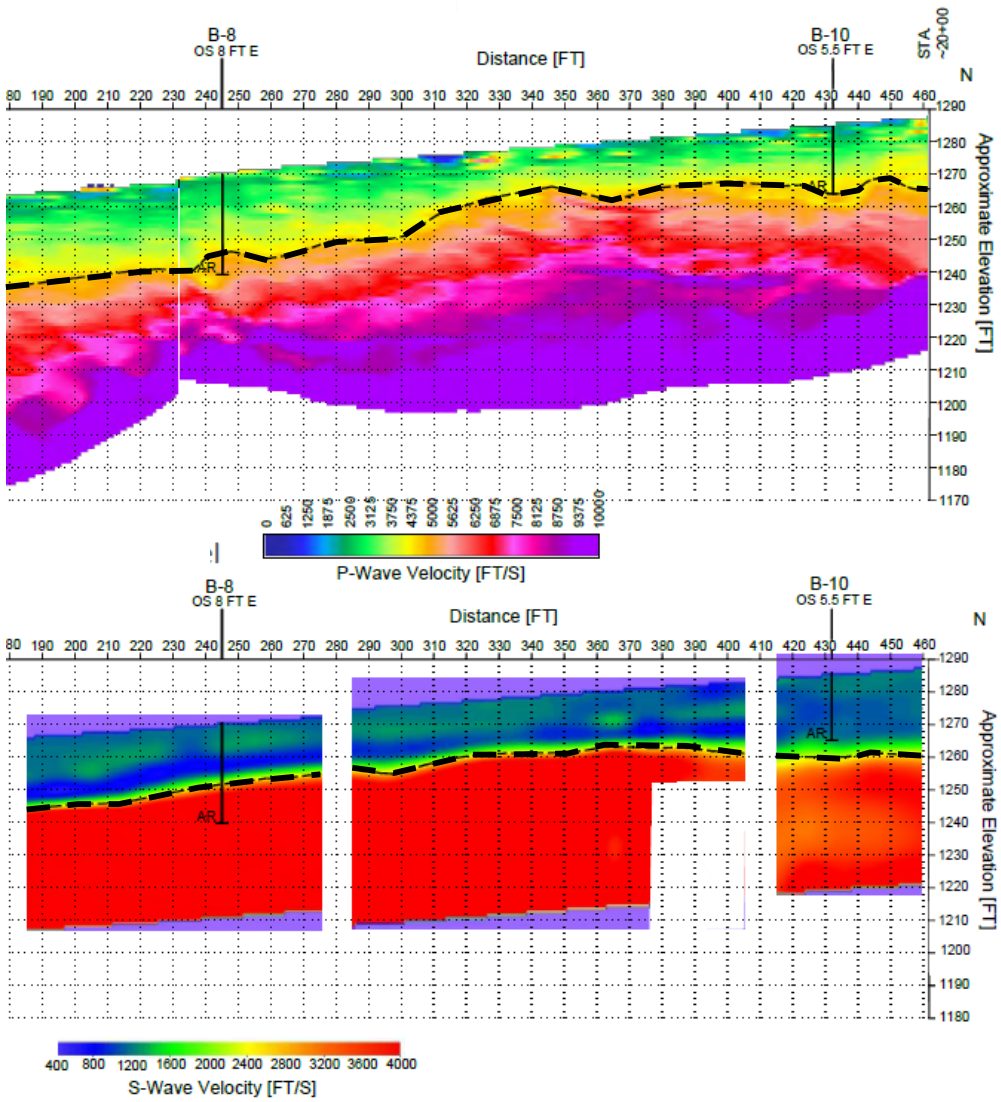


Support for Wall Design



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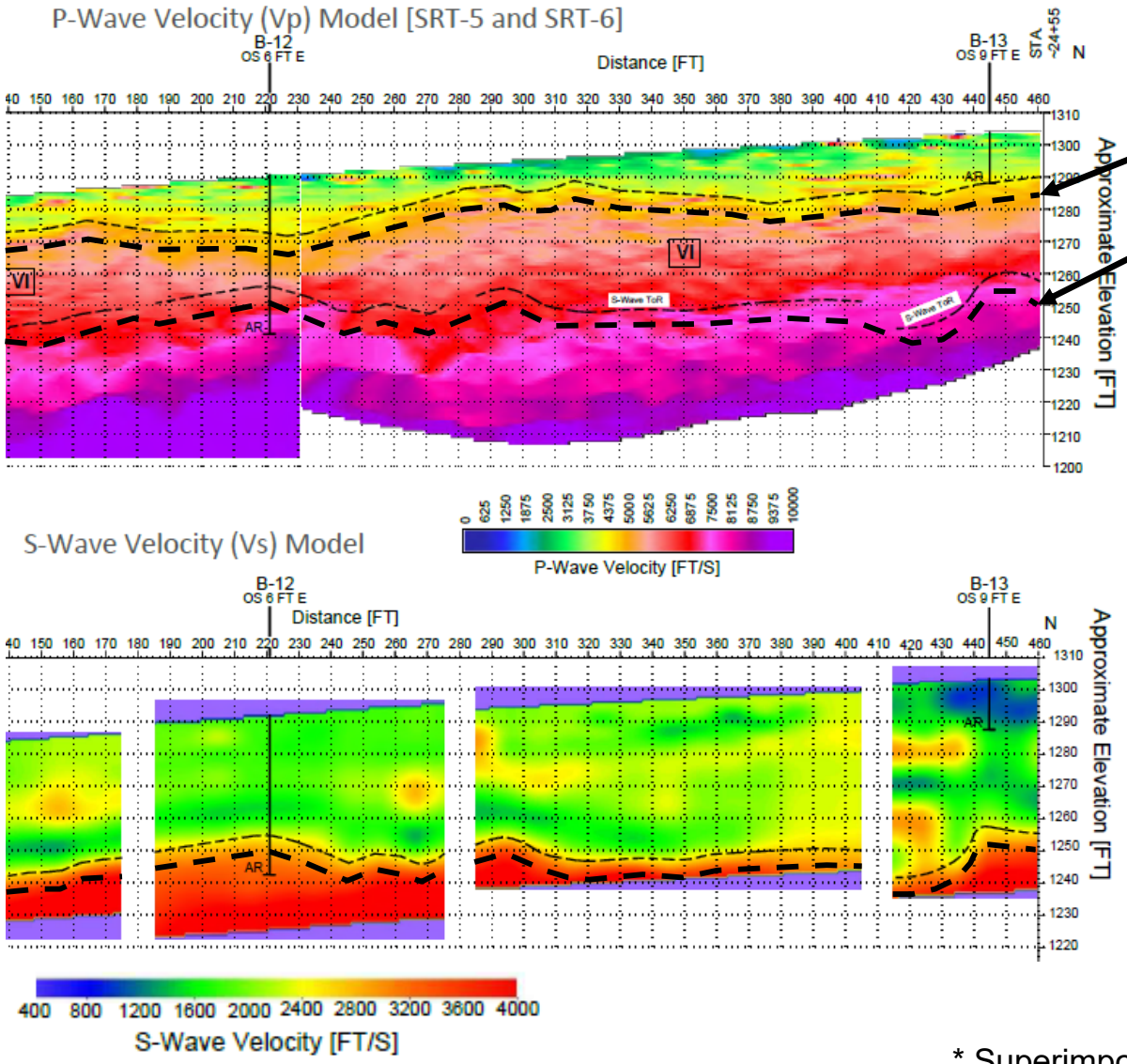
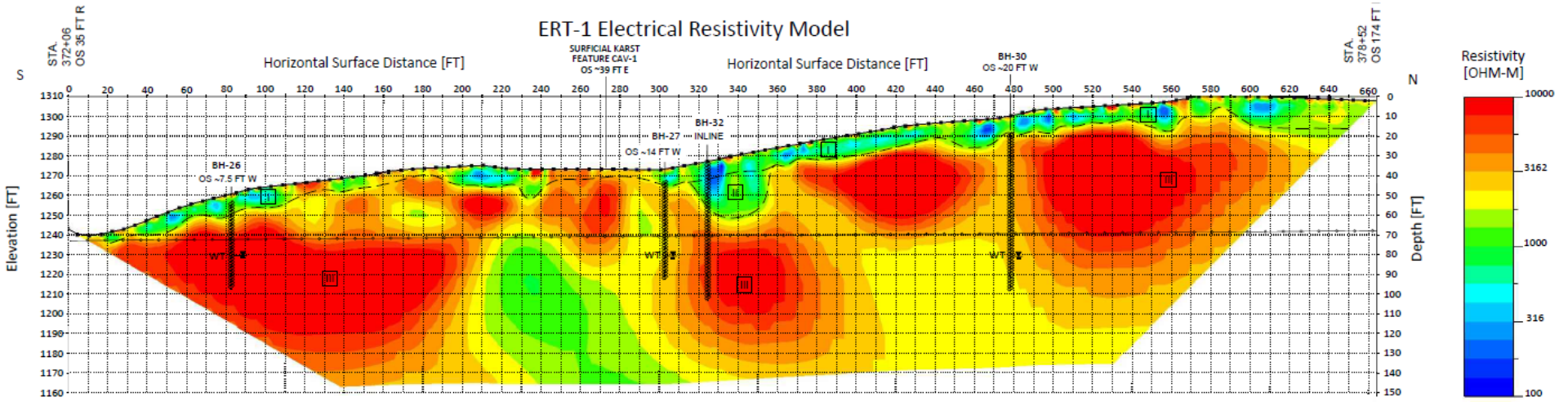


P-Wave

S-Wave *

* Superimposed from s-wave velocity model, based on elevation.

Roadway Improvement – Complex Geology



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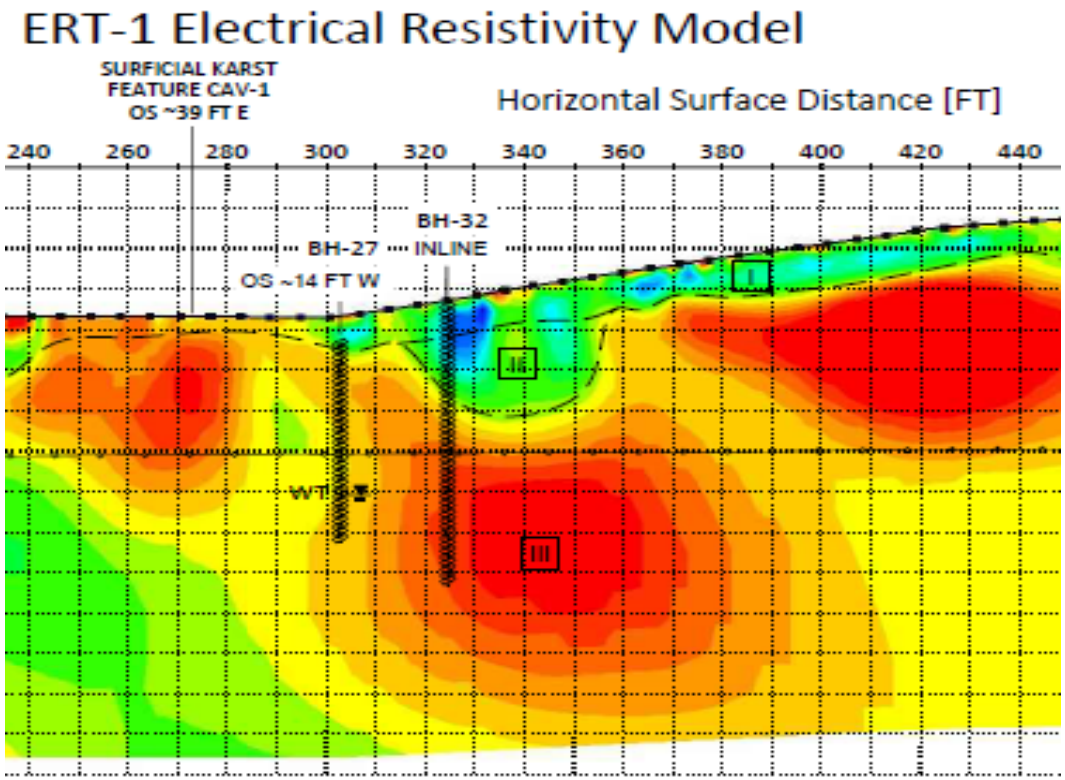

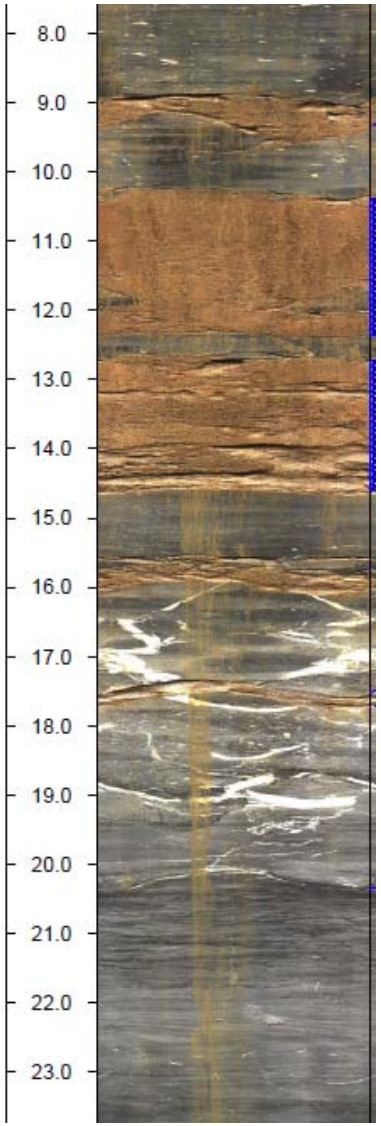

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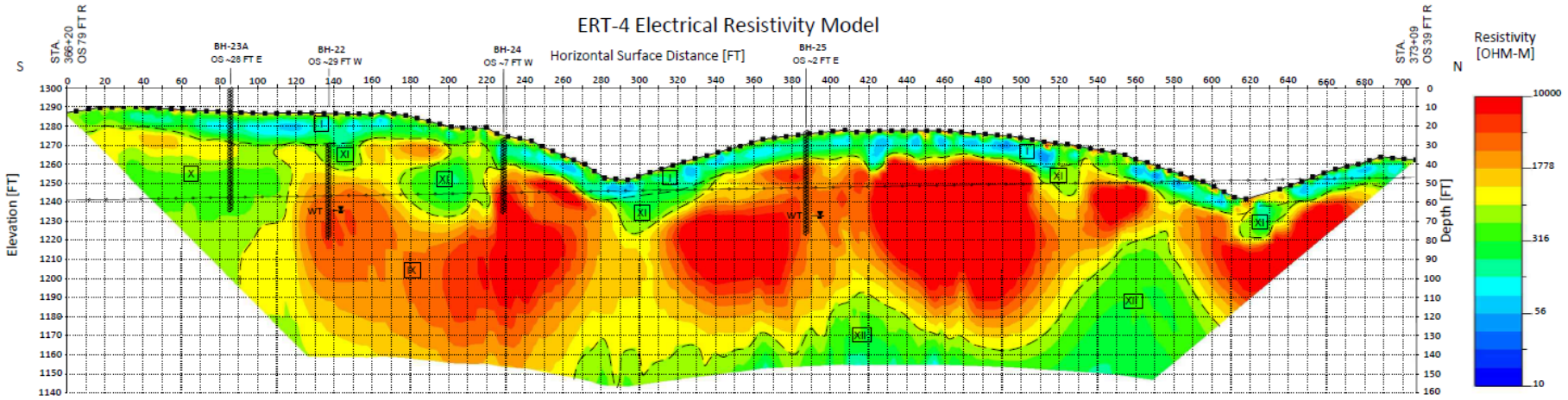

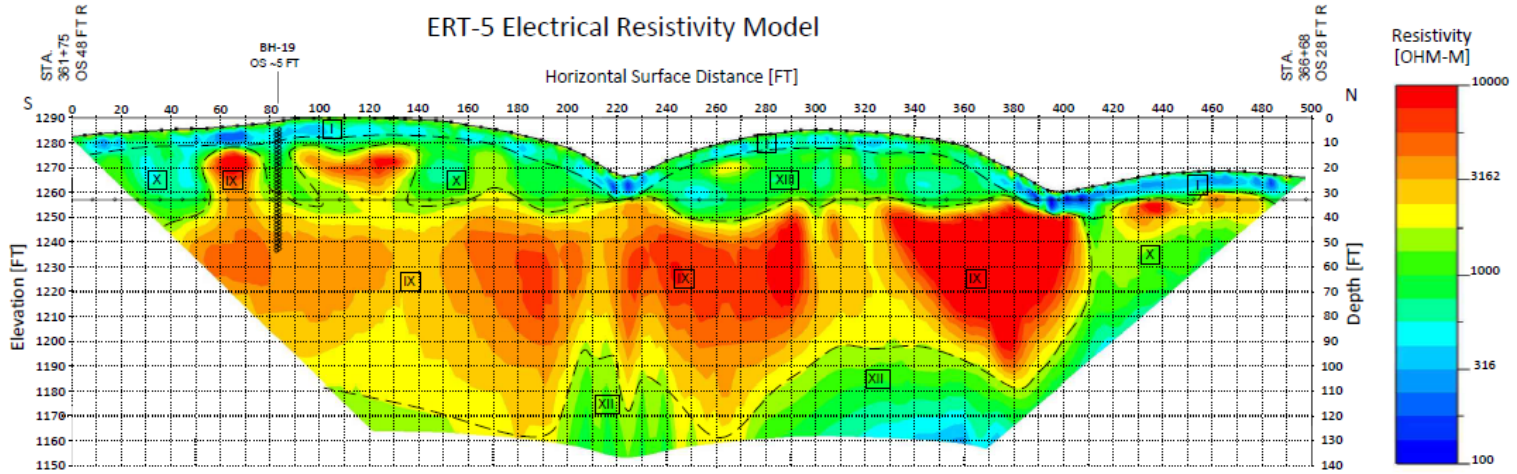

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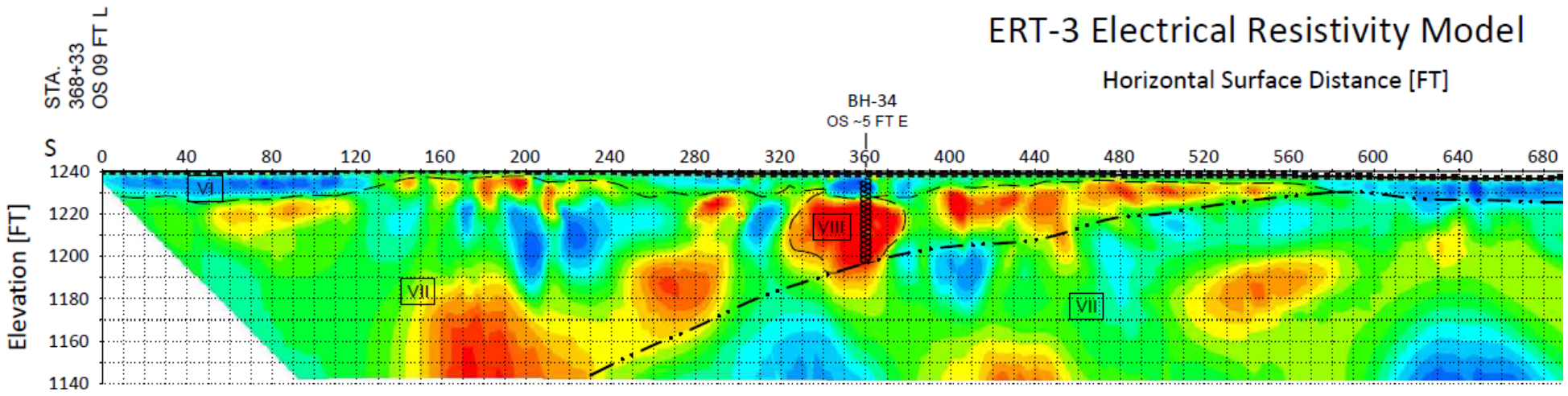

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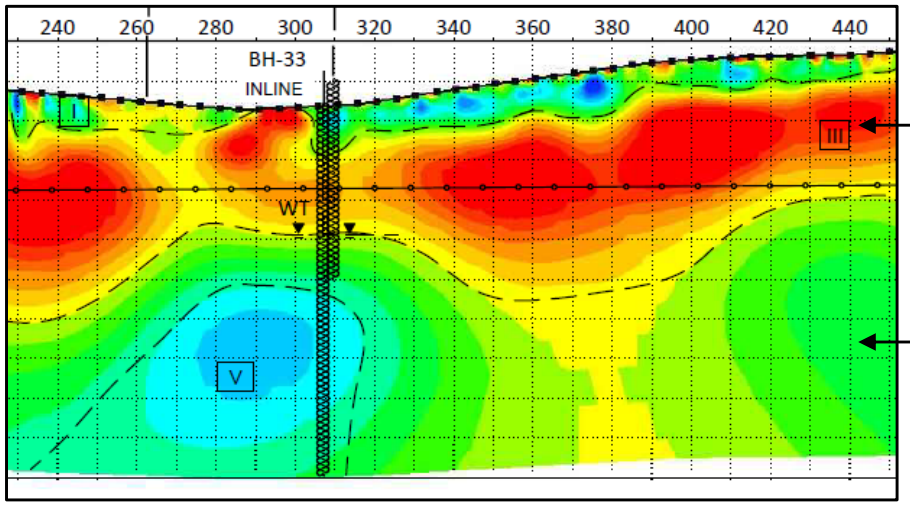
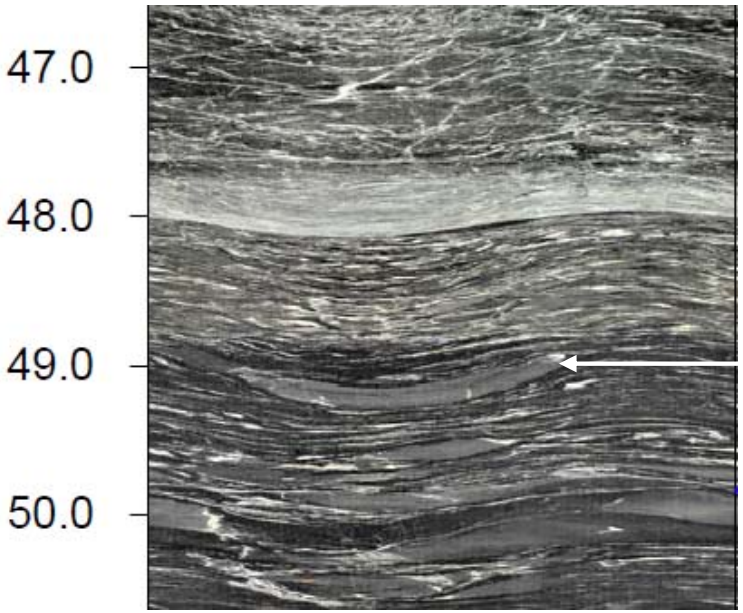
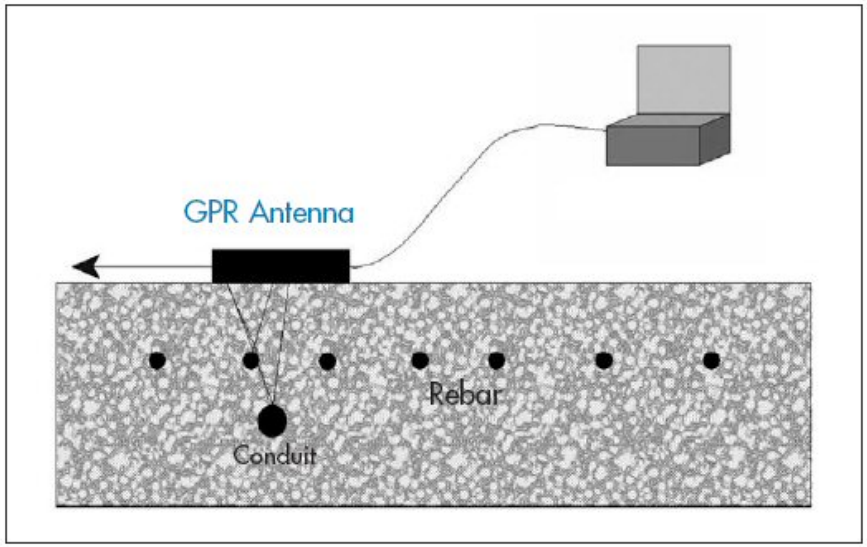
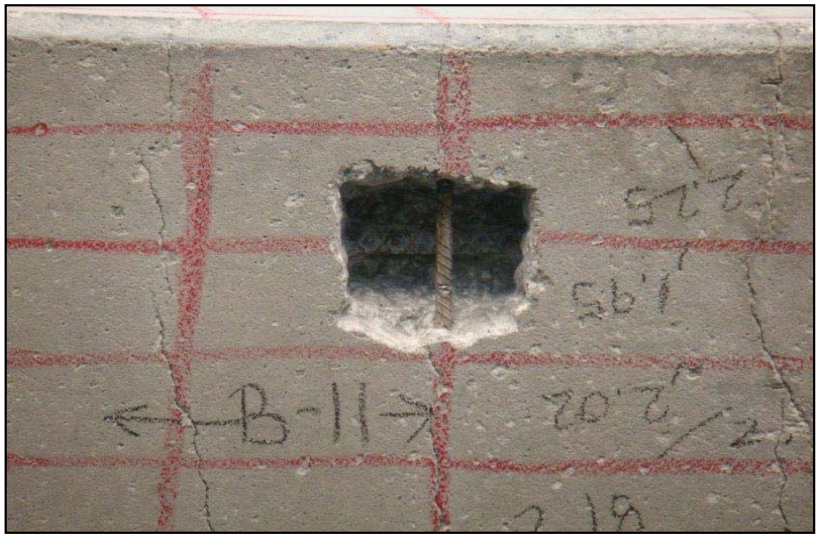


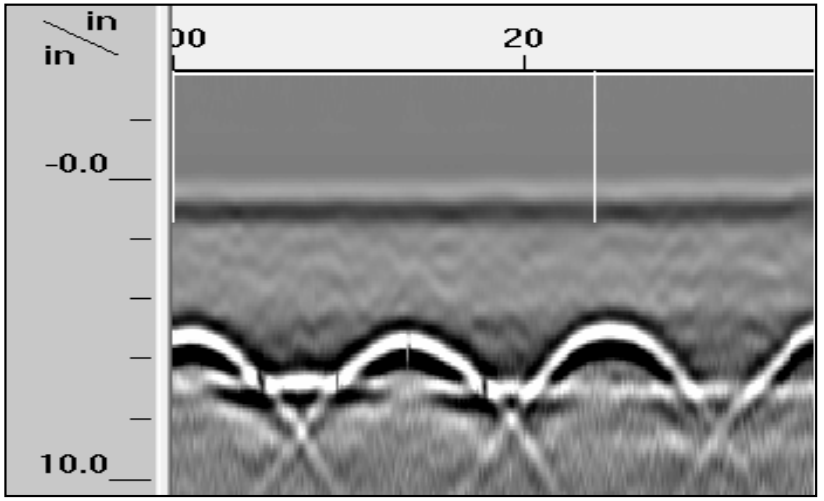


NDT EVALUATION FOR EXISTING STRUCTURES

Ground Penetrating Radar

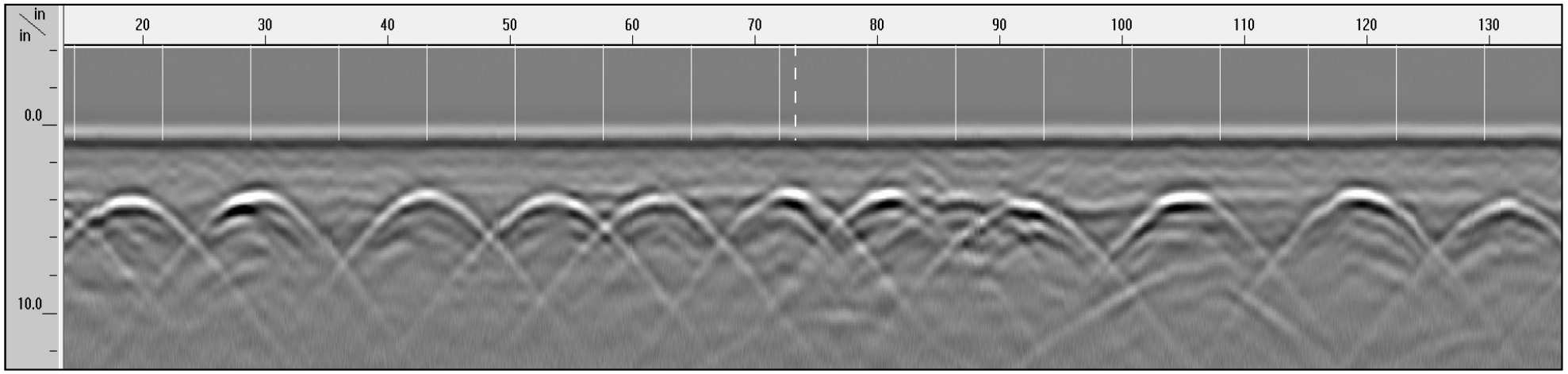




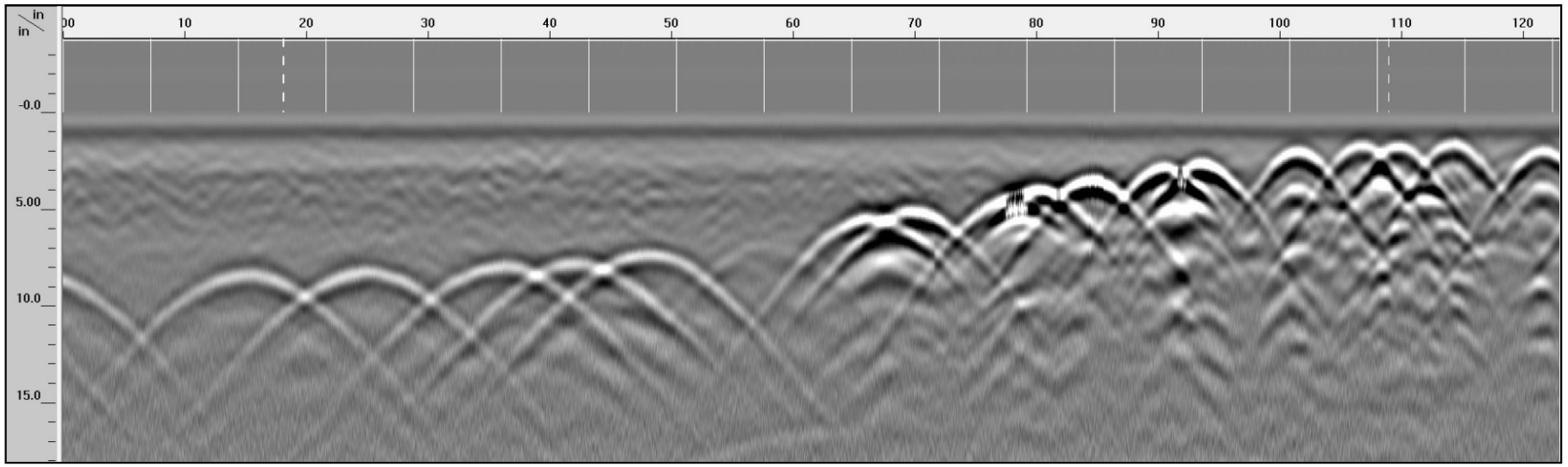


Off Center Rebar Cage

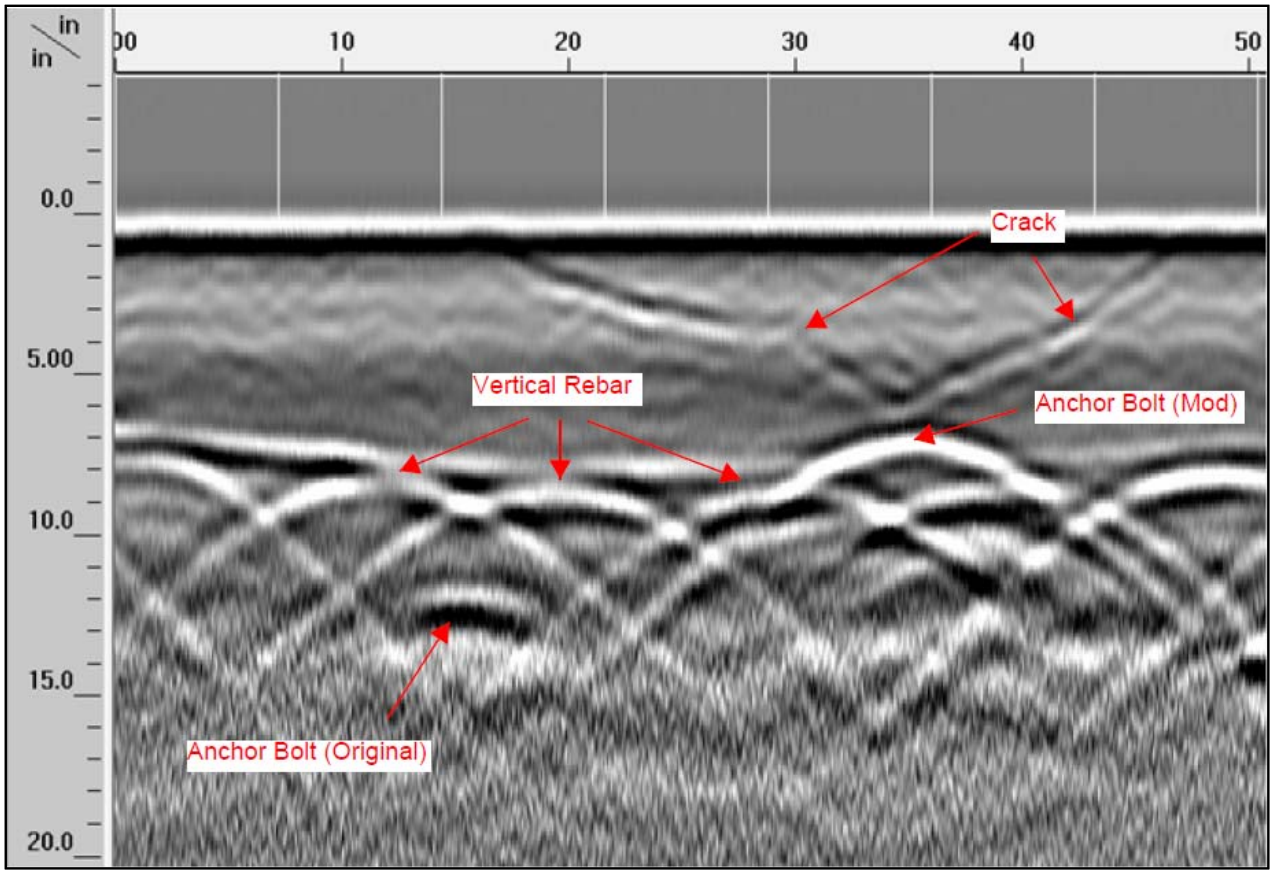
Properly Installed Rebar Cage



Poorly Installed Rebar Cage

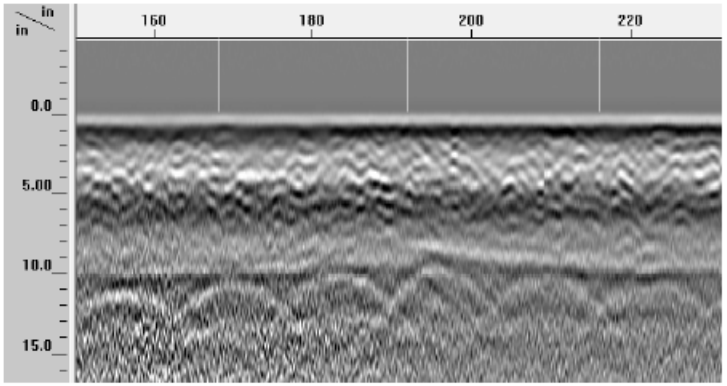


Off Center Rebar Cage
With Anchor Bolt Modification

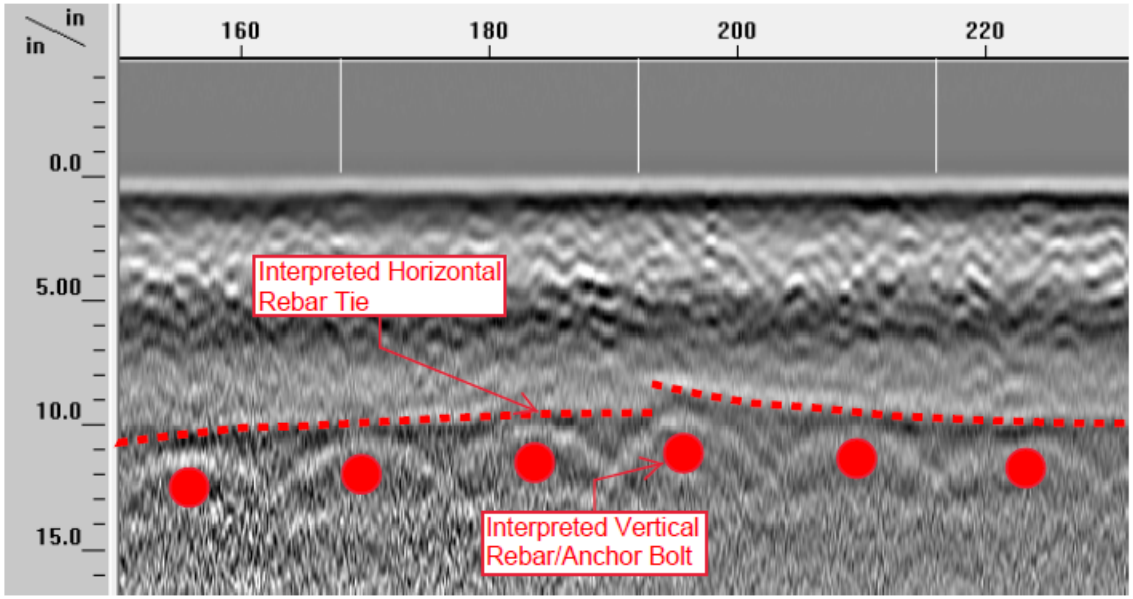


Rebar Cage – Tie Overlap

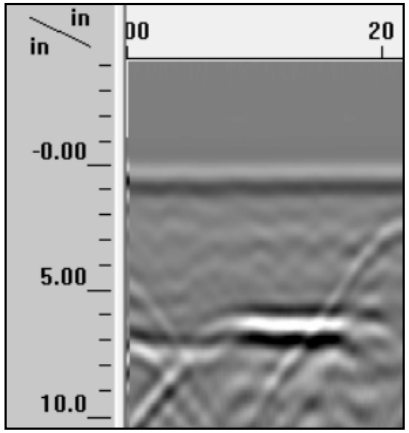
Raw GPR Record

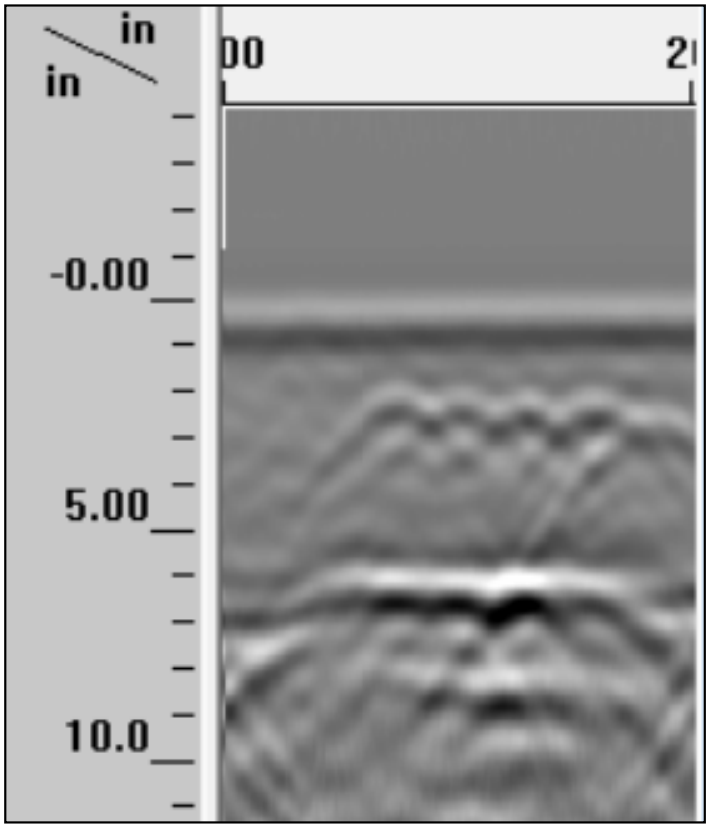


Annotated GPR Record

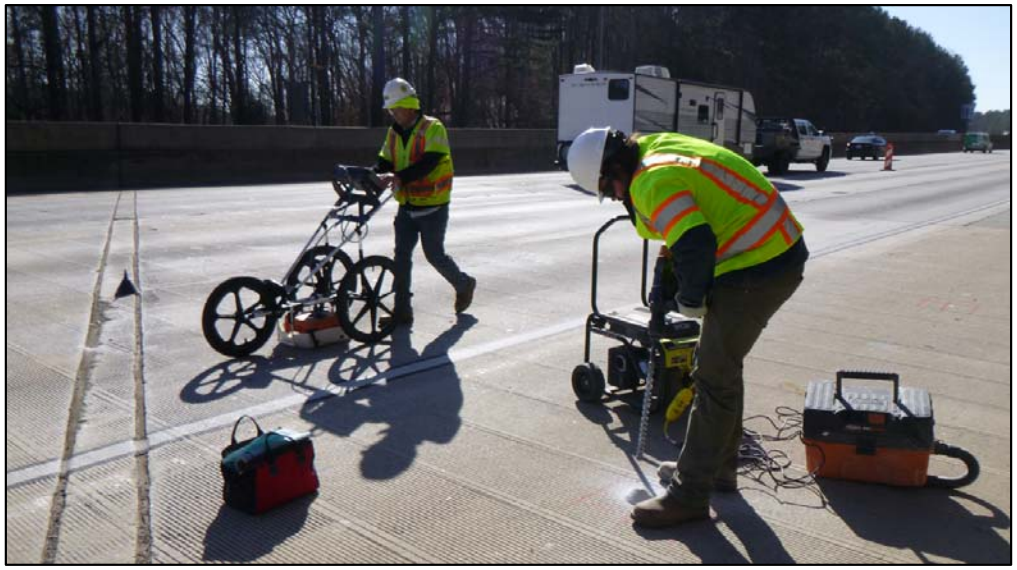


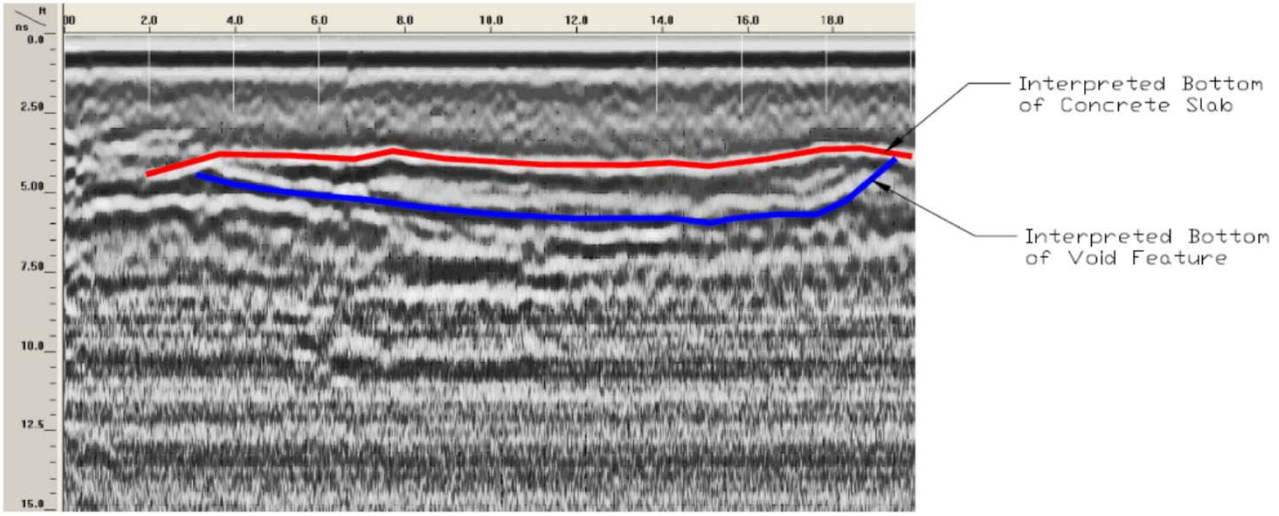
Bridge Beams – Shear Pins



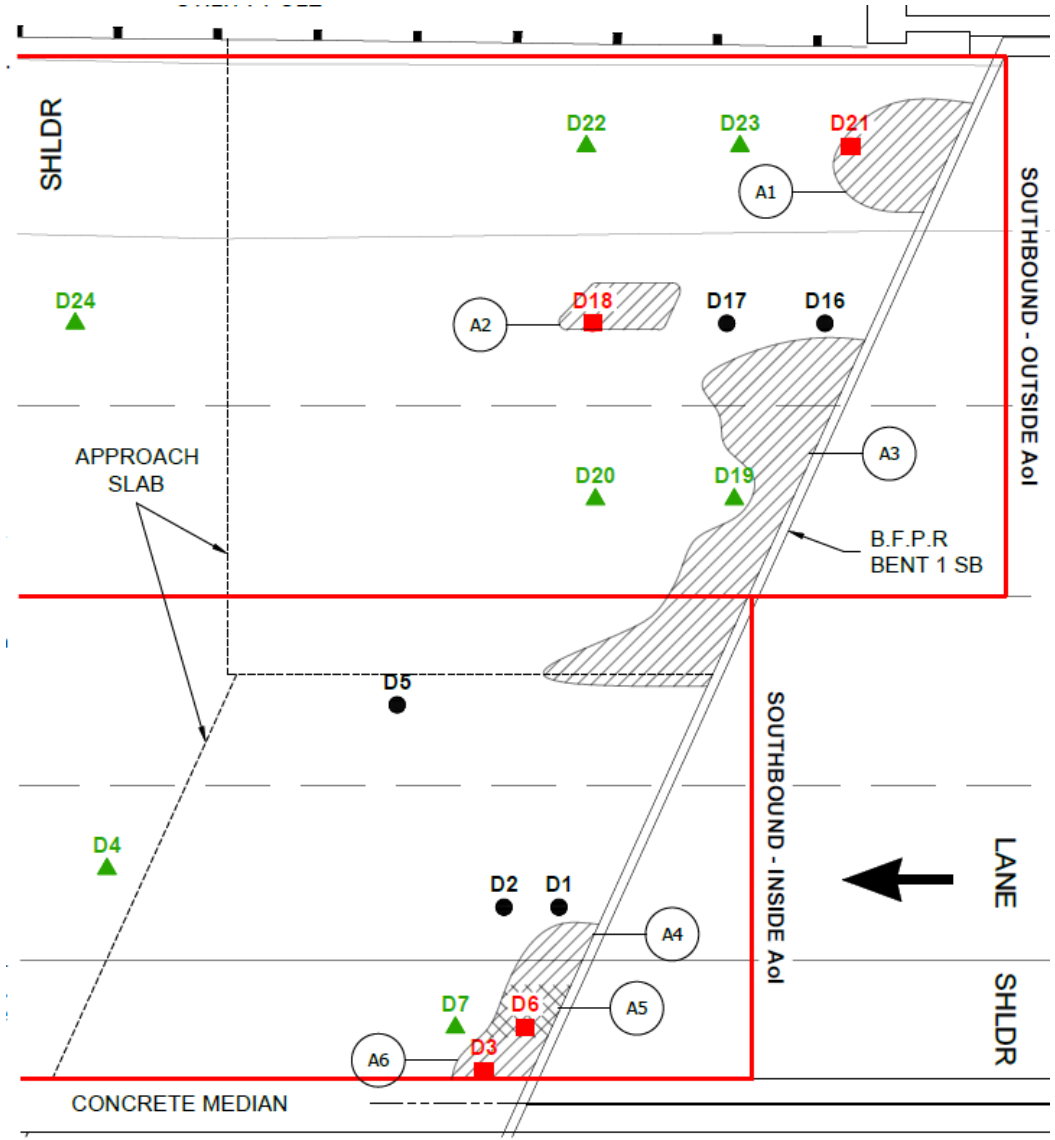


Void Under Bridge Approach Slab

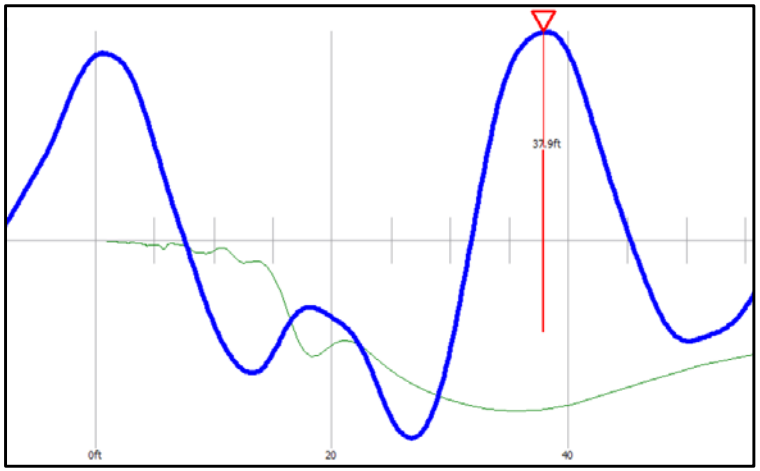


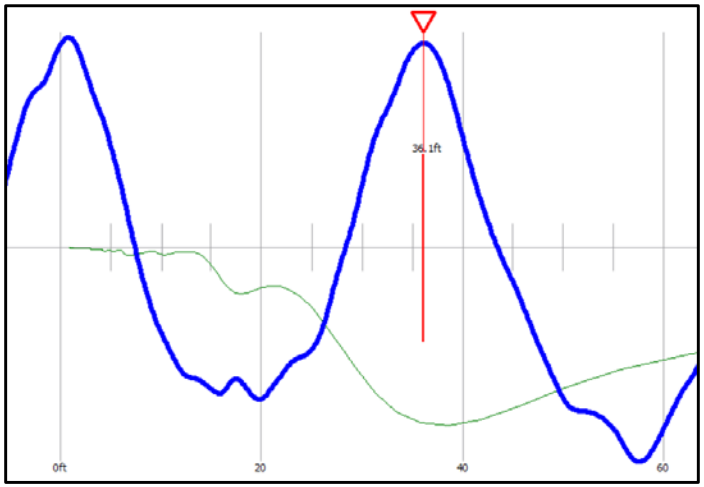


Void Under Bridge Approach Slab

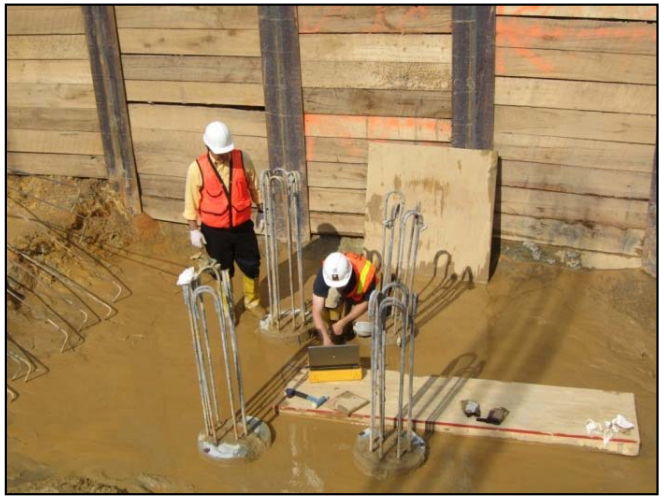


SHEETPILE

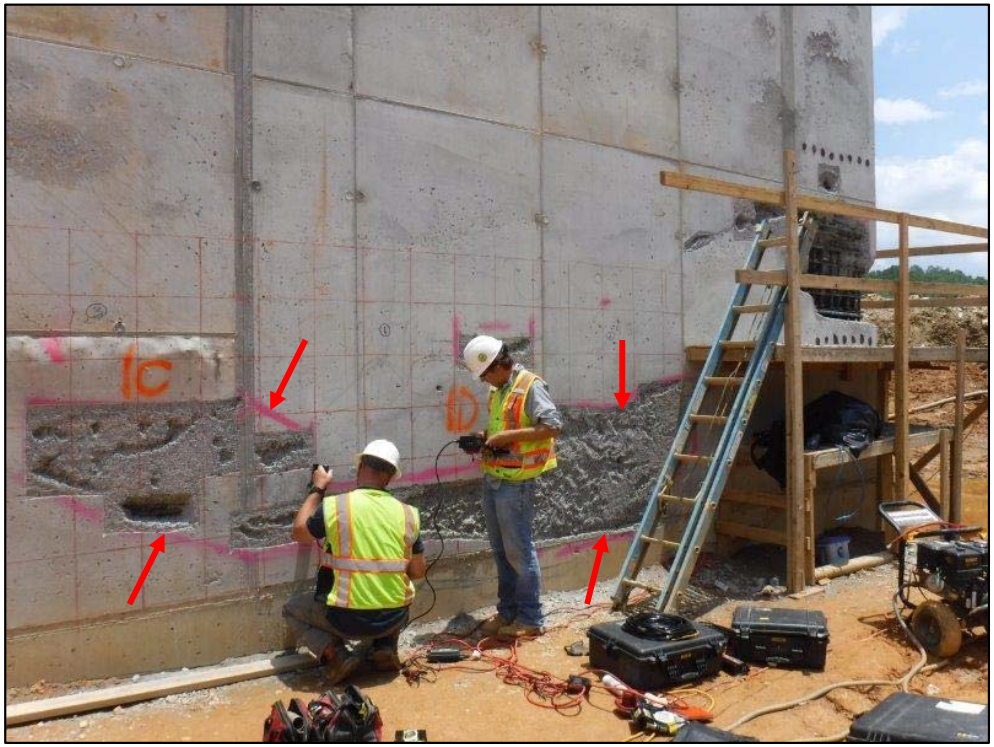




QA For Deep Foundations



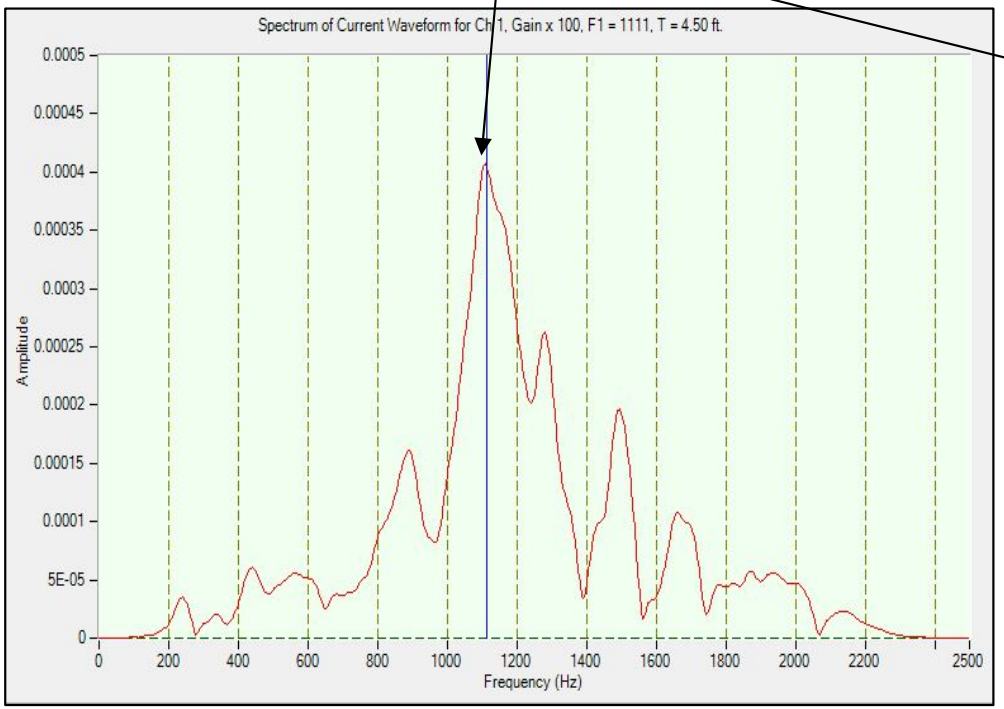
Bridge Footing QA

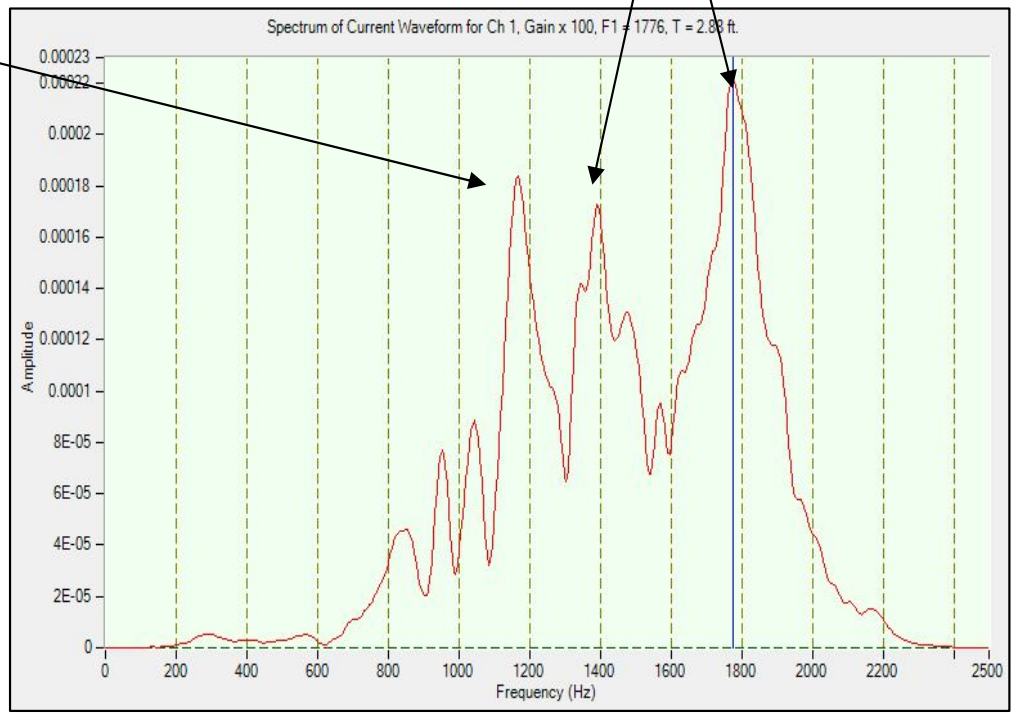


Bridge Footing QA

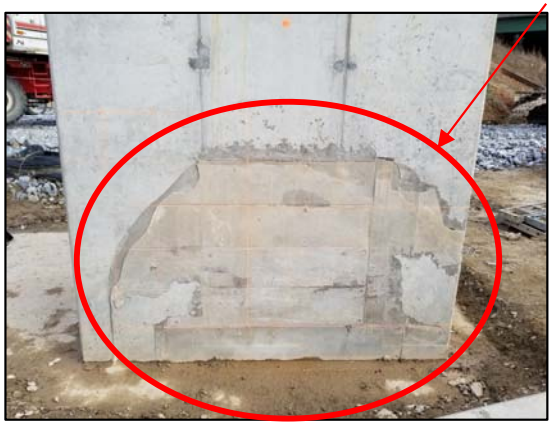
PEAK FROM BACKSIDE OF ELEMENT

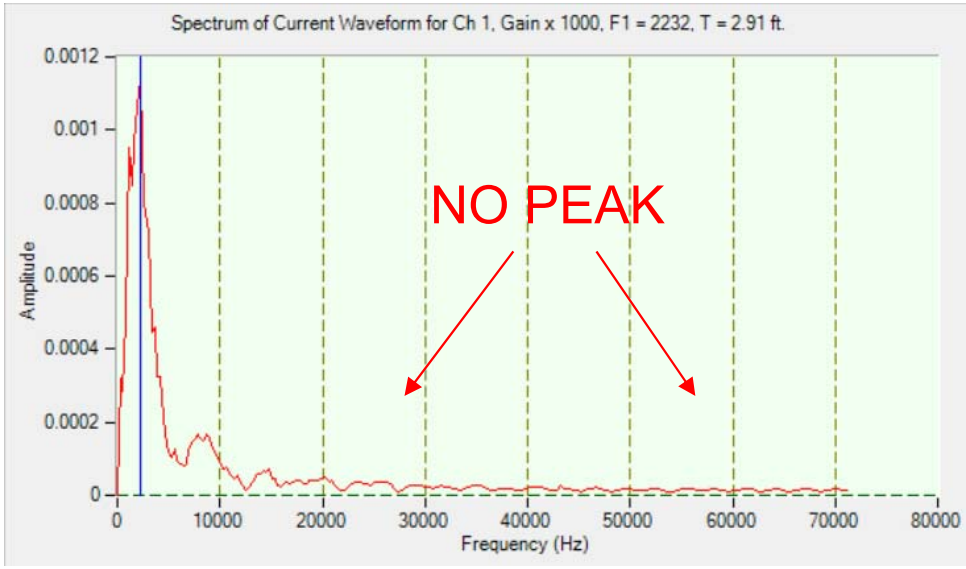
SHALLOW PEAK – POSSIBLE DEFECT





Bridge Column – Concrete Patch QA





Questions?