



CTL ENGINEERING HAS THE ABILITY TO PROVIDE GEOPHYSICAL TESTING INCLUDING: 2D AND 3D ELECTRICAL RESISTIVITY AND INDUCED POLARIZATION SURVEYS, REFRACTION MICROTREMOR (REMI) SURVEYING AND GROUND PENETRATING RADAR TO ASSIST IN PERFORMING NON-DESTRUCTIVE SUBSURFACE EXPLORATIONS

CTL ENGINEERING 2D AND 3D ELECTRICAL RESISTIVITY IMAGING:

CTL Engineering has the ability to provide geophysical testing including 2D and 3D electrical resistivity and induced polarization surveys to assist in performing non-destructive subsurface explorations.

Electrical Resistivity Imaging (ERI) is a geophysical technique used to create an image of a specific portion of the Earth's subsurface. ERI may be used to locate and/or identify features, such as karst, voids, buried structures, tanks, differing geology, groundwater sources, burial plots; as well as analyses of volumetric aggregate resources, aquifers, and bedrock features.

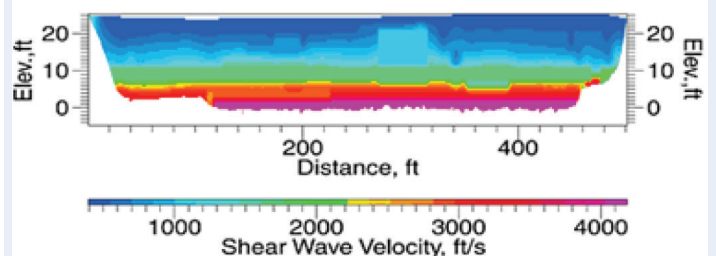
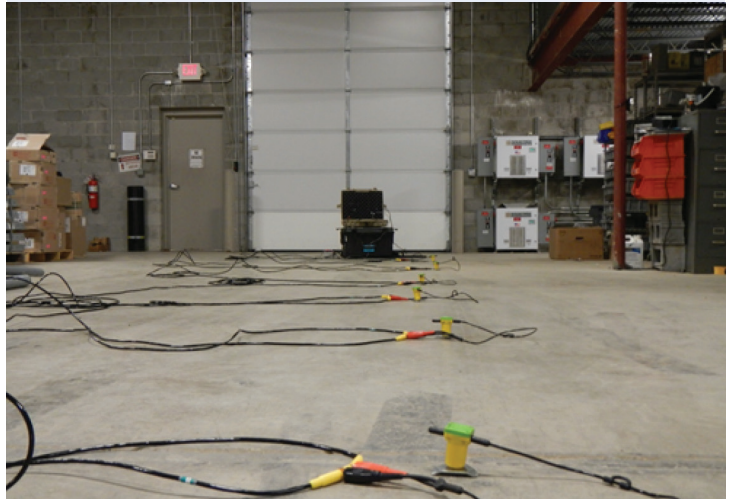
ERI involves measuring the resistivity of the earth along a single profile or a series of profiles. A number of stainless steel electrodes are driven into the ground at evenly spaced intervals. The length of profile, depth of penetration, and resolution determine the electrode spacing, which can be anywhere from a few feet to several hundred feet or more.

These are used to build up an image of the subsurface. We can create two or three dimensional resistivity images, depending on the survey conducted.

INDUCED POLARIZATION:

The Induced Polarization (IP) response reflects the degree to which the subsurface soils are able to store electrical charge.

The polarization results from a redistribution of ions along fluid interfaces following application of an electric current. This current is measured and analyzed to help identify mineral components of the subsurface soils and rock. IP can be used to explore for ore, identify clay content and pore fluid composition, as well as to map subsurface contamination, providing a more accurate, non-destructive profile of the underlying soils, decreasing risk and providing thousands of dollars in materials costs savings.



The above map depicts a utility tunnel, shown as a blue square, sitting just below a layer of concrete, depicted as the long green line.

REFRACTION MICROTREMOR:

CTL Engineering has the ability to provide geophysical testing including refraction microtremor (REMI) surveying to assist in performing non-destructive subsurface investigations.

ReMi technology functions by measuring the velocity of ambient acoustic waves (Shear Waves) beneath the surface, effectively returning a reviewable image of subsurface conditions.

Shear Wave receivers, known as geophones, are placed in

intervals above the area being explored. These receivers take individual readings of incoming shear wave velocities and compile

REFRACTION MICROTREMOR CONTINUED ON NEXT PAGE

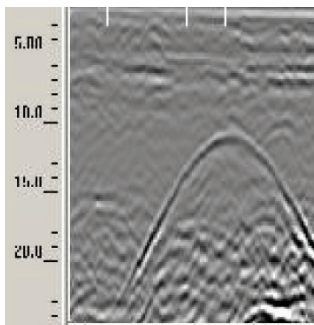
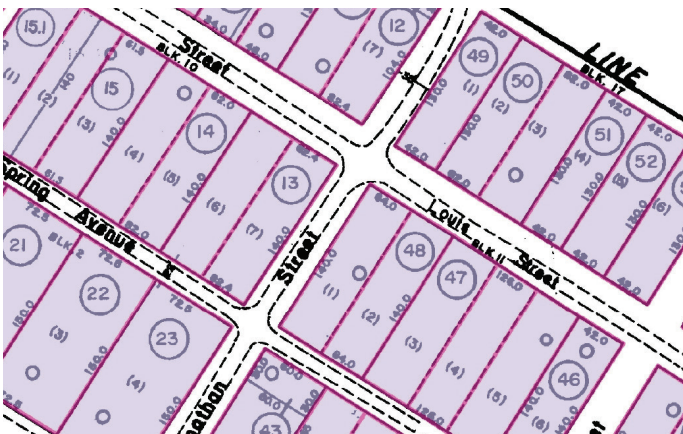
them inside a computer creating a graph.

Based on the wave velocities read from the geophone, engineers are able to decipher what materials lie beneath the surface. Refraction MicroTremor is significant because it is both cost efficient and simple to use.

By using ReMi to measure the Shear Wave Velocities of the soils, we can eliminate the conservative constraints that are required in the International Building Code when using the traditional method of Standard Penetration Testing (SPT) to determine the Seismic Site Classification. This design scale rates the earthquake resistivity of soils at the site of construction. As a building's Seismic Design Category increases, building material costs tend to dramatically increase in response.

REMI USES:

- Seismic Design Categories
- Subsurface Mapping



GROUND PENETRATING RADAR:

Ground Penetrating Radar is the best technology in non-destructive investigations of earthen and concrete structure.

GPR uses pulsed Electromagnetic waves similar to aircraft radar to see changes in electrical properties such as conductivity.

- Best at seeing sharp contrasts (reflection)
- Measures "time to target and back" as well as the strength of the return signal
- Metal targets reflect 100% of signal

GROUND PENETRATING RADAR CONTINUED:

GPR USES:

- Utility Detection and Mapping
- Concrete Inspection and Evaluation
- Geology and Geophysics
- Highway Inspection
- Bridge Inspection
- Archeology
- Railbed Inspection
- Airport Inspection
- Forensics
- Precision Farming
- Environmental
- Architectural Facades Inspection
- Snow/Ice Thickness Measurement
- University Research
- Detecting Minerals/Mining

GPR ASPECTS AND STRUCTURESCAN ADVANTAGES:

- Frequencies from 16 MHz - 3 GHz
- Average radiated power is approximately 1% of cell phone transmitted power.
- Practical Limits
 - To 36 inches in concrete
 - To 30 feet in earth
 - To 100 feet to detect water tables and bedrock in earth
 - To 1,000 feet in ice
- Easily inspects floors, walls, decks, slabs, tunnels, balconies, and garages
- Accurately locates rebar, tension cables, conduits (PVC and metal), voids, and measures slab thickness
- Locates targets to depths of 18 inches
- Thousands of square feet of concrete can be inspected in a day
- Faster, safer, and lower cost than radiography (X-Ray)
- Only single-sided access needed
- Fully FCC compliant
- Built with pride in the USA