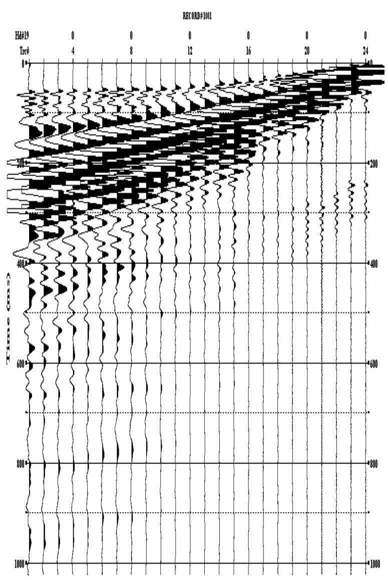
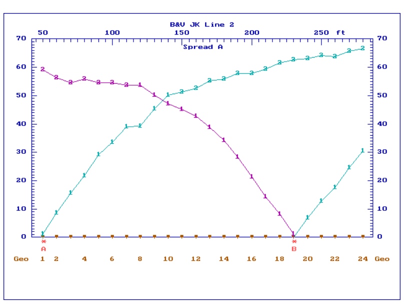
SAIC®
An Employee-Owned Company

SEISMIC SERVICES

Seismic surveys depend upon the mechanical transfer of energy from one soil or rock grain to the next in the subsurface. A seismograph, in its simplest form, is a high-resolution timing device measuring the time from the introduction of seismic energy into the ground until it reaches a sensor (geophone) that translates ground motion into voltages. Commonly, 24 or more geophones are laid out in a straight line to measure the subsurface energy. Within the subsurface, energy reflects and refracts at subsurface boundaries. Subsurface velocities can be calculated with knowledge of the time and distance to the geophones. Distances, interferences, velocities, and observations about the way the energy moves in the subsurface provide insight into numerous subsurface properties.



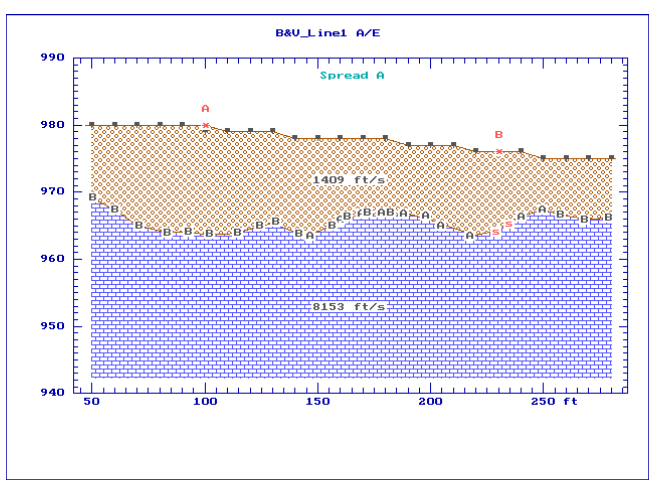


A ***seismic refraction*** survey depends on the seismic energy refracting or traveling along an interface between materials of two different velocities. Plotting the time to first energy arrival against geophone distances, the velocity of subsurface materials can be calculated. These velocities can be modeled into an estimate of subsurface depths accurate to within 10 percent. Seismic refraction surveys are typically used to a few hundred feet maximum and are commonly used for top-of-rock and bedrock rippability surveys. Refraction surveys are the most commonly requested seismic survey.

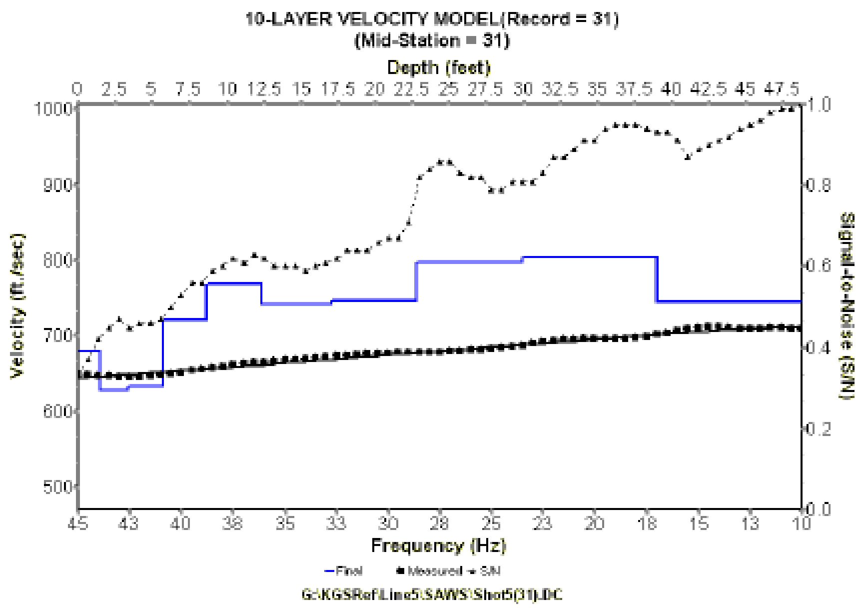
Seismic Applications

- ✓ **Depth to Bedrock**
- ✓ **Depth to Water Table**
- ✓ **Site Classification for Seismic Design**
- ✓ **Bedrock Rippability**
- ✓ **Bedrock Lithology**
- ✓ **Bedrock Faults/ Fractures**
- ✓ **Engineering Properties**
  - ◆ **Poisson's Ratio**
  - ◆ **Young's Modulus**
  - ◆ **Shear Modulus**
  - ◆ **Bulk Modulus**

Geophysical Services
Tel: (800) 944-6778



Science Applications International Corporation



A ***seismic refraction*** survey depends on energy bouncing off the interface between materials with two different acoustic impedances (velocity and density). Based around common offset distances, the reflected energy presents a parabolic appearance. The shape of the parabola can be used to estimate seismic velocities. Seismic reflection surveys can be used to depths of several thousand feet.

Shear wave surveys utilize energy related to particle movement that is different than the direction of energy propagation. By striking the side of an object at the ground surface, energy can be made to move from side to side as it reflects and refracts in the subsurface. This kind of survey is commonly used to determine engineering properties of Poisson's ratio, bulk mudulus, shear modulus, and Young's modulus.

Surface wave dispersion is a means of using surface wave noise from a common refraction survey to estimate the shear wave velocity.

Seismic Sources

Seismic surveys are dependent on the ability to get energy into the ground. SAIC has familiarity and experience with a variety of seismic sources. Seismic energy can originate with a sledgehammer blow upon a steel plate, an elastic wave generator throwing a 100-pound cylinder to the ground. For some surveys, a blank shotgun shell is detonated into the subsurface, and for other surveys dynamite is used. For vertical seismic surveys and crosshole surveys, a mechanical device is used within the borehole.

Other Geophysical Services

- ✓ Crosshole Seismic Surveys
- ✓ Resistivity
- ✓ Ground-Penetrating Radar
- ✓ Electromagnetic Terrain Conductivity
- ✓ Utility Locating
- ✓ Magnetics
- ✓ Gravity
- ✓ Time Domain
- ✓ Magnetotelluric Surveys
- ✓ Borehole Video
- ✓ Borehole Wireline Surveys
    - Caliper
    - Temperature
    - Resistivity
    - Spontaneous Potential
    - Flow

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