Ground penetrating radar (GPR) is an electromagnetic profiling technique utilised for high resolution mapping of subsurface features. It is commonly applied to mapping soil layers, depths to bedrock, buried stream channels, rock fracture zones and cavities; buried waste materials (both bulk and drummed); buried utilities (both metallic and nonmetallic); and buried cultural features.

The technique operates on the principle of transmission and reflection of short duration electromagnetic pulses from a transducer that is moved across the ground surface. The energy radiates down through the subsurface and is reflected back to the receiving antenna from subsurface electrical discontinuities. Variations in the continuously recorded returning signals are sent to a control unit for processing and display.

The record produced by the GPR is a continuous, cross-sectional picture or profile of subsurface conditions within the depth of penetration. The time the electromagnetic pulse takes to travel from the transmitting antenna to the buried object or interface and back to the receiving antenna is proportional to the depth of the buried object or interface. This time is a two-way travel time and is dependent on the dielectric properties of the media through which the pulse travels. The dielectric properties (electrical permeability and conductivity) are a function of the composition and moisture content of the subsurface soil and rock materials.

The depth of penetration is highly site specific and is limited by attenuation of the outgoing pulse. The GPR system is more effective in seeing through insulators to conductors. Greater penetration is obtained in dry, sandy, and rocky soils and little penetration is obtained from moist, clayey conductive soils. Penetration generally ranges from one to ten metres although penetrations of more than 30 metres have been achieved under certain ideal conditions.

A major advantage of GPR is the continuity of recorded data; it provides a continuous vertical profile. Data is also acquired at a relatively high speed. In some applications, work can be accomplished by using a vehicle or boat to tow the radar antenna.

Applications

- Detection of buried objects such as tanks or pipes
- Forensic investigations
- Subsurface layer mapping for foundation studies, engineering and environmental studies
- Shallow geologic mapping
- Shallow water table mapping
- Void detection
- Reinforcing bar mapping in concrete