Geophysical Services

Environmental • Groundwater • Geotechnical

Ground Penetrating Radar

Buried Object Delineation

UST and Pipeline Locates

Void Detection

Shallow Stratigraphic Mapping

INTRODUCTION

Ground penetrating radar (GPR) is used to image buried objects and stratigraphy at shallow depths, providing continuous, real-time profiles of the subsurface. It can be very useful in locating underground tanks, pipes, trenches, and other buried materials. For stratigraphic mapping, GPR can be used to map fill boundaries, shallow bedrock, and other shallow stratigraphy.

GPR is also used in archeological and forensic investigations. Using higher frequency (shorter wavelength) antennas, GPR applications include mapping voids beneath pavement or concrete slabs, pavement, concrete, and rebar inspections. Borehole and crosshole antennas are also available.

PRINCIPLES OF OPERATION

Ground penetrating radar (GPR), like other radar techniques, sends out an electromagnetic pulse (radio wave or microwave) which is reflected off a “target” and returns to the receiver. GPR operates at lower frequencies (80-500 MHz) than other radar to obtain better penetration in the earth materials. The antenna is pulled slowly along the ground surface to produce a continuous subsurface profile.

The photo above shows a GPR unit in operation. The 400 MHz antenna is shown in a GPR cart with the SIR3000 control unit mounted to the handle bar and an integrated Trimble DGPS.

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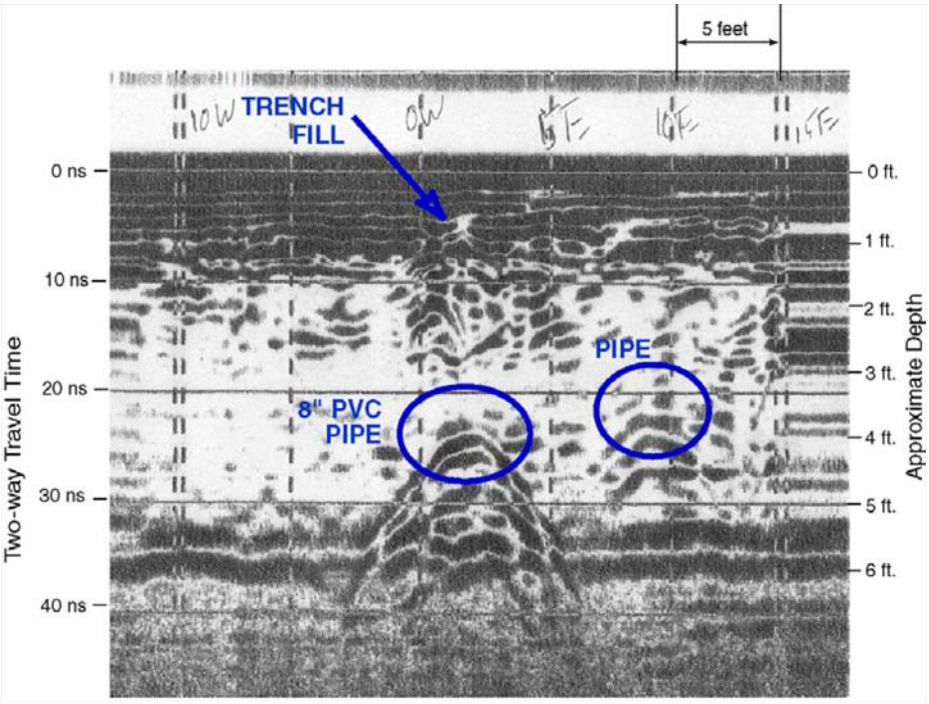
Ground Penetrating Radar



EXAMPLE

Above is an example of a GPR profile over two shallow pipes. The vertical scale is a time scale, giving the time for the radar pulse to travel down to the reflector and return to the receiver. Knowing the pulse velocity in the soils, we can convert this to depth. The horizontal scale corresponds to distance along the surface. Fiducial time marks on the record are placed at five or ten foot intervals. The pipe reflector shown appears as a hyperbola on the record. The pipe produces a strong reflection with a characteristic ringing of the electronics, which appears as a dark band below the first arrival from the pipe.

The above example, which was obtained in an asphalt covered parking lot, shows an 8 inch PVC storm drain at a depth of approximately 4 feet, and another unidentified pipe 8 feet to the east (right). Some indication of the fill material in the trench can also be seen in the shallow section.

APPLICATIONS

GPR is primarily a tool for investigating selected areas in detail. Its continuous subsurface profiles give a graphic portrayal of subsurface conditions, and often provide an excellent means of accurately locating pipes and tanks. However, the GPR depth of exploration is strongly dependent on soil conductivity and subsurface conditions. In dry, sandy soils useful data may be obtained from depths down to 25 feet, whereas in conductive clay-rich soils, investigation depth is often limited to two or three feet.

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