Electrical Resistivity Tomography Survey

Electrical resistivity tomography survey is a geophysical method for subsoil exploration. The electrical resistivity of any conducting material having a length L and an area of cross-section A can be defined as

$$\rho = \frac{RA}{L} \quad (3.84)$$

Where, **R= electrical resistance**

The unit of resistivity is ***ohm-meter*** or ***ohm centimeter***. The resistivity of various soil depends on their moisture content and also on the concentration of dissolved **irons** in them. Dry soil and rocks have a high resistivity whereas saturated clays have a very low. The range of resistivity of various soil and rocks is given in **Table 3.13**.

TABLE 3.13 Representative Values of Resistivity

Material	Resistivity (ohm · m)
Sand	500–1500
Clays, saturated silt	0–100
Clayey sand	200–500
Gravel	1500–4000
Weathered rock	1500–2500
Sound rock	>5000

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The most common procedure for measuring a soil profile's electrical resistivity is using four electrodes driven into the ground and equally spaced along a straight line. The procedure is referred to as wenner method which is illustrated in **Figure 3.48a**.

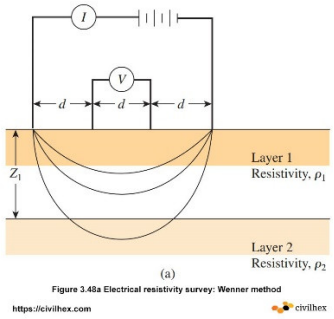

Figure 3.48a Electrical resistivity survey: Wenner method

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The two outside electrodes (usually a dc current with nonpolarizing potential electrodes) are used to send an electrical current ***I*** into the ground. **The current is typically a range between 50 to 100mA**. The voltage drop ***V*** is measured between the two inside electrodes. If the soil profile is homogeneous then its electrical resistivity is

$$\rho = \frac{2\pi dV}{I}$$

In many cases, the soil profile may consist of various layers with different resistivity and **Eq. (3.85)** will give the apparent resistivity. To obtain the actual resistivity of various layers and their thicknesses, there

has an empirical method that involves conducting tests at various electrode spacings. As shown in **Figure 3.48b**, the sum of apparent resistivities, $\sum\rho$, is plotted against the spacing *d*.

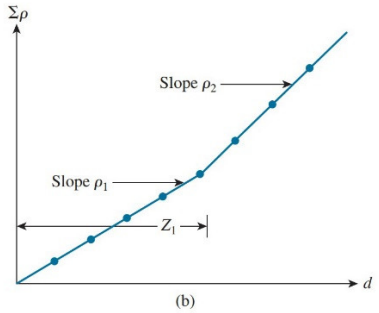

Figure 3.48b Electrical resistivity survey: empirical method

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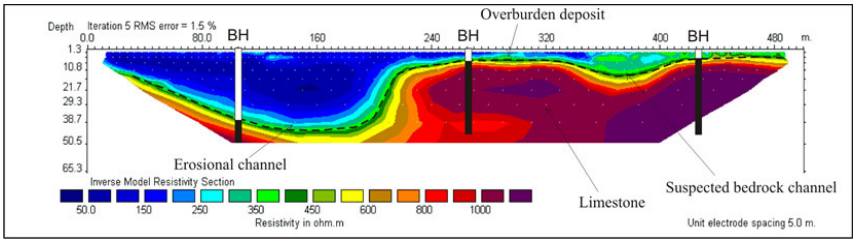
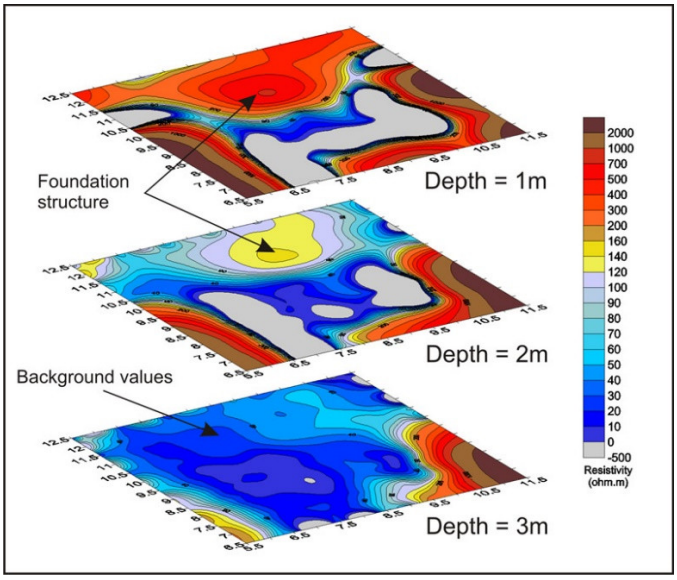
Particularly the electrical resistivity tomography survey is useful in locating gravel deposits within a fine-grained soil. Some recent geophysical methods include ground penetrating radar (GPR), multichannel analysis of the surface waves (MASW), and spectral analysis of surface waves (SASW). The geophysical methods are very effective in covering large areas. In addition to determining the soil profile, these methods can also be used to determine the velocity of the shear wave which is an important property in dynamic soil problems.

See this video: how to practically do the electrical resistivity tomography survey

https://www.youtube.com/watch?v=EPipLGVt7V4

Electrical Resistivity Tomography Survey Report Sample





Reference:

Principles of Foundation Engineering (Ninth edition, 2019), "Braja M. Das, University Sacramento", "Nagaratnam Sivakugan, College of Science & Engineering James Cook University"

FAQ

Q1. Electrical resistivity tomography survey.

Ans: Electrical resistivity tomography survey is a geophysical method for subsoil exploration. Generally, this method is used for subsurface exploration at large coverage terrain.