Soil Resistivity Property

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Introduction

- Resistivity is basic parameter to measure the conductive property of materials.
- Resistivity of the soil, which varies with parameters such as moisture content, temperature and depth effected earth resistance value.
- The resistance of an earth electrode influenced by resistivity of the soil.
- The resistance of a conductor depends on the atomic structure of the material or its resistivity.
- The SI unit of resistivity is the Ohm-meter (Ωm)

Influence factors on soil resistivity

- Soil resistivity values are widely varying depending on the type of terrain.
- Factors that affect resistivity are:-
- 1) Type of earth
- 2) Stratification; layers of different types of soil
- 3) Moisture content level
- 4) Temperature
- 5) Chemical composition and concentration of dissolved salt

Table of Resistivity

Type of Soil or Water	*Typical Resistivity Ωm*	*Usual Limit Ωm*
Sea water	2	0.1 to 10
Clay	40	8 to 70
Ground well & spring water	50	10 to 150
Clay & sand mixtures	100	4 to 300
Shale, slates, sandstone etc	120	10 to 100
Peat, loam & mud	150	5 to 250
Lake & brook water	250	100 to 400
Sand	2000	200 to 3000
Moraine gravel	3000	40 to 10000
Ridge gravel	15000	3000 to 30000
Solid granite	25000	10000 to 50000
Ice	100000	10000 to 100000

Resistivity values for several types of soils and water

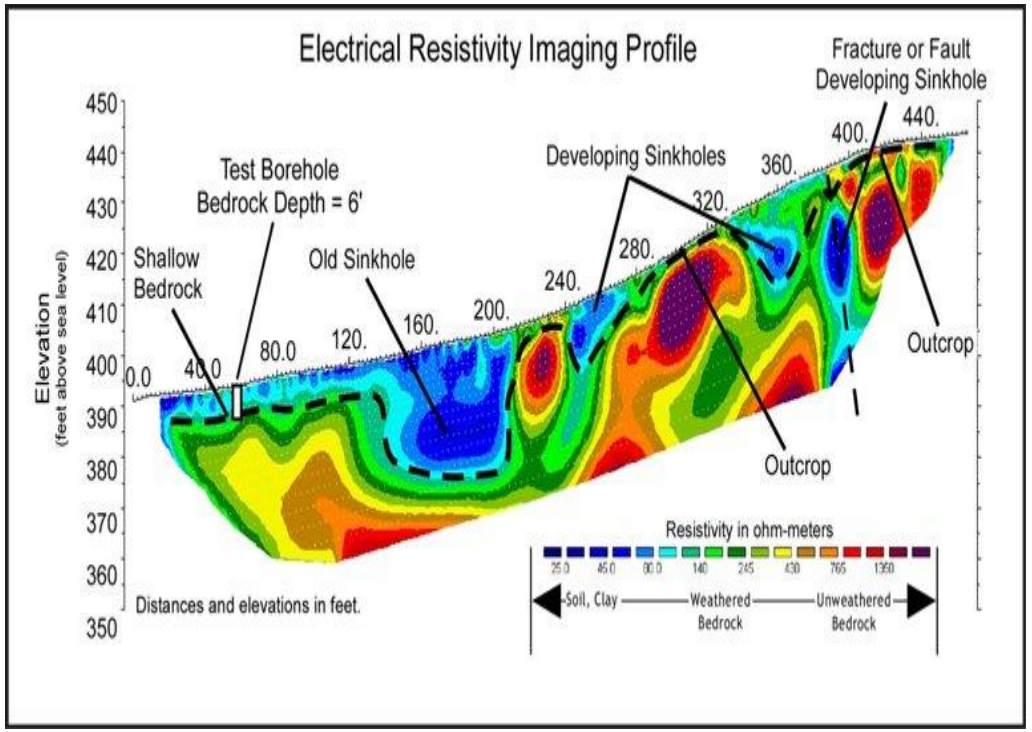
	Typical resistivity Ωm	
Moisture % by weight	*Clay mixed with sand*	*Silica based sand*
0	10 000 000	-
2.5	1 500	3 000 000
5	430	50 000
10	185	2 100
15	105	630
20	63	290
30	42	-

Variations in soil resistivity with moisture content

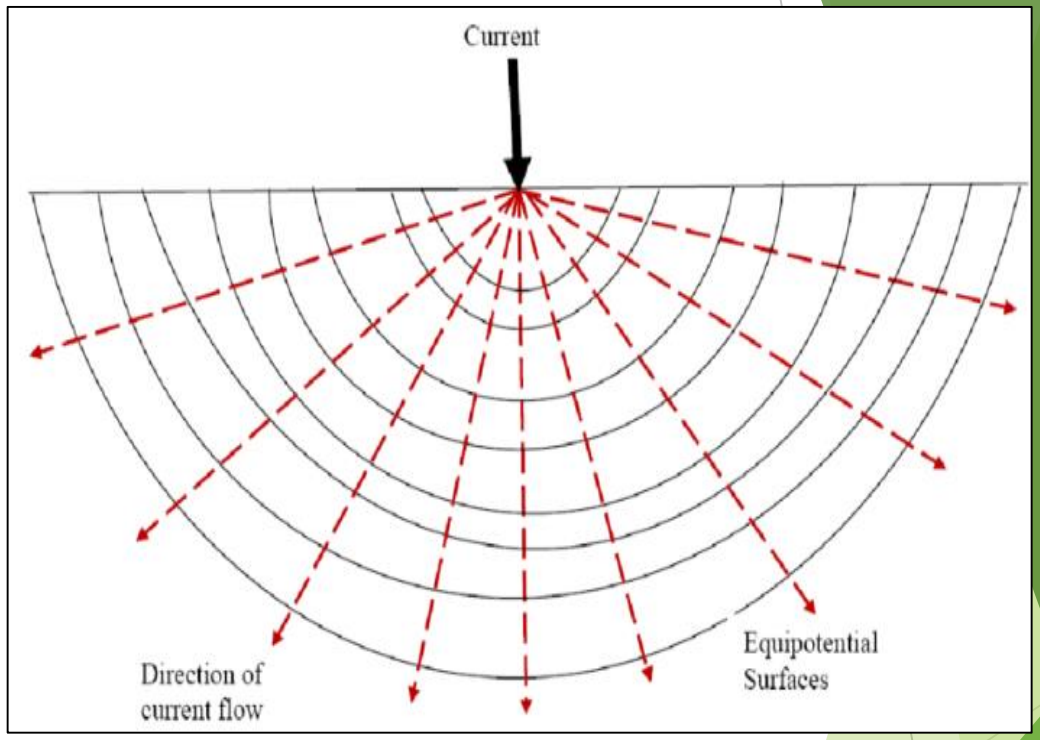
Temp. C	*Typical resistivity Ωm*
20	72
10	99
0 (water)	138
0 (ice)	300
-5	790
-15	3300

Variations in resistivity with temperature for a mixture of sand and clay with a moisture content of about 15% by weight

Geoelectric Resistivity



Electrical Resistivity Imaging Profile



Current from a point source and the resulting equipotential distributions.

Why Soil Resistivity Matters for Grounding

- Currents flow into surrounding soil from a ground electrode described as flowing through a series of concentric shells of increasing diameter.
- Greater area for current flow observed lower resistance due to the current dissipation becomes large enough.
- The dissipation of the electrical current running through the system will result in a higher voltage on the grounding system.
- Implications in certain application such as higher touch or step potentials, or in more extreme cases failure of reliable operation of over-current or over voltage devices.

Conclusion

- Defining the electrical properties of a portion of the earth, a distinction between geoelectric and geologic model is required.
- The changes in resistivity determined by geoelectric model the boundaries between layers.
- Primarily, dependent upon water and chemical content and texture.
- Effective current flow observed lower resistance of grounding system.