

Table 7—Typical surface material resistivities

| Number | Description of surface material (U.S. state where found) | Resistivity of sample Ω·m | |
|--------|---|---|--|
| | | Dry | Wet |
| 1 | Crusher run granite with fines (N.C.) | 140×10^6 | 1300 (ground water, 45 Ω·m) |
| 2 | 1.5 in (0.04 m) crusher run granite (Ga.) with fines | 4000 | 1200 (rain water, 100 W) |
| 3 | 0.75–1 in (0.02–0.025 m) granite (Calif.) with fines | — | 6513 (10 min after 45 Ω·m water drained) |
| 4 | #4 (1–2 in) (0.025–0.05 m) washed granite (Ga.) | 1.5×10^6 to 4.5×10^6 | 5000 (rain water, 100 Ω·m) |
| 5 | #3 (2–4 in) (0.05–0.1 m) washed granite (Ga.) | 2.6×10^6 to 3×10^6 | 10 000 (Rain water, 100 Ω·m) |
| 6 | Size unknown, washed limestone (Mich.) | 7×10^6 | 2000–3000 (ground water, 45 Ω·m) |
| 7 | Washed granite, similar to 0.75 in (0.02 m) gravel | 2×10^6 | 10 000 |
| 8 | Washed granite, similar to pea gravel | 40×10^6 | 5000 |
| 9 | #57 (0.75 in) (0.02 m) washed granite (N.C.) | 190×10^6 | 8000 (ground water, 45 Ω·m) |
| 10 | Asphalt | 2×10^6 to 30×10^6 | 10 000 to 6×10^6 |
| 11 | Concrete | 1×10^6 to 1×10^9 ^a | 21 to 100 |

^aOven dried concrete (Hammond and Robson [B78]). Values for air-cured concrete can be much lower due to moisture content.

13.2 Classification of soils and range of resistivity

A number of tables exist in the literature showing the ranges of resistivity for various soils and rocks. The tabulation from Rüdberg [B125] has the advantage of extreme simplicity. More detailed data are available in engineering handbooks and publications (for instance, Sunde [B130] and Wenner [B150]). See Table 8.

13.3 Resistivity measurements

Estimates based on soil classification yield only a rough approximation of the resistivity. Actual resistivity tests therefore are imperative. These should be made at a number of places within the site. Substation sites where the soil may possess uniform resistivity throughout the entire area and to a considerable depth are seldom found. Typically, there are several layers, each having a different resistivity. Often, lateral changes also occur, but in comparison to the vertical ones, these changes usually are more gradual. Soil resistivity tests should be made to determine if there are any important variations of resistivity with depth. The number of such readings taken should be greater where the variations are large, especially if some readings are so high as to suggest a possible safety problem.