



METER

December 14, 2017

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### ASTM D5334 Thermal Resistivity Testing results, December 2017

The thermal resistivity ( $\rho$ ) of five soil samples received from [Redacted] under RMA [Redacted] was measured at the as-received water content and bulk density and after drying using the TEMPOS thermal properties analyzer with the TR-3 sensor in accordance with ASTM-D5334. The samples were received unconsolidated in bags, and were remolded into rigid-walled tubes to a bulk density represented by intact peds. Measurements were made at three separate insertion locations in each sample. The TEMPOS was configured in high power mode with a 5 minute read time for the moist samples. After sample drying, a 10 minute read time and thermal grease were used to prevent errors from thermal contact resistance between the sensor and the sample. The accuracy of the TR-3 sensor and associated TEMPOS unit was verified using a Delrin verification standard immediately before the measurements on the test samples. All measurements were performed at room temperature. Dry bulk density, water content, and thermal resistivity data from the samples are presented in Table 1 and Figure 1.

Sample designations are as follows:

[Redacted]

Sample	Dry bulk density (g/cm <sup>3</sup> )	Water content (g/g)	Average rho (°C·cm/W)	Standard deviation
[Redacted]	1.39	0.23	64.2	10.14
[Redacted]	1.44	0.27	49.7	2.15
[Redacted]	1.52	0.24	48.4	1.65
[Redacted]	1.48	0.27	53.1	1.39
[Redacted]	1.42	0.20	57.1	0.64
[Redacted] dry	1.39	0.00	183.9	4.65
[Redacted] dry	1.44	0.00	170.6	9.47
[Redacted] dry	1.52	0.00	151.7	5.20
[Redacted] dry	1.48	0.00	147.6	4.52
[Redacted] dry	1.42	0.00	243.3	5.48

Table 1. Measured bulk density, water content, and thermal resistivity for the samples in SI units. The thermal resistivity values represent the average of three measurements on each sample.



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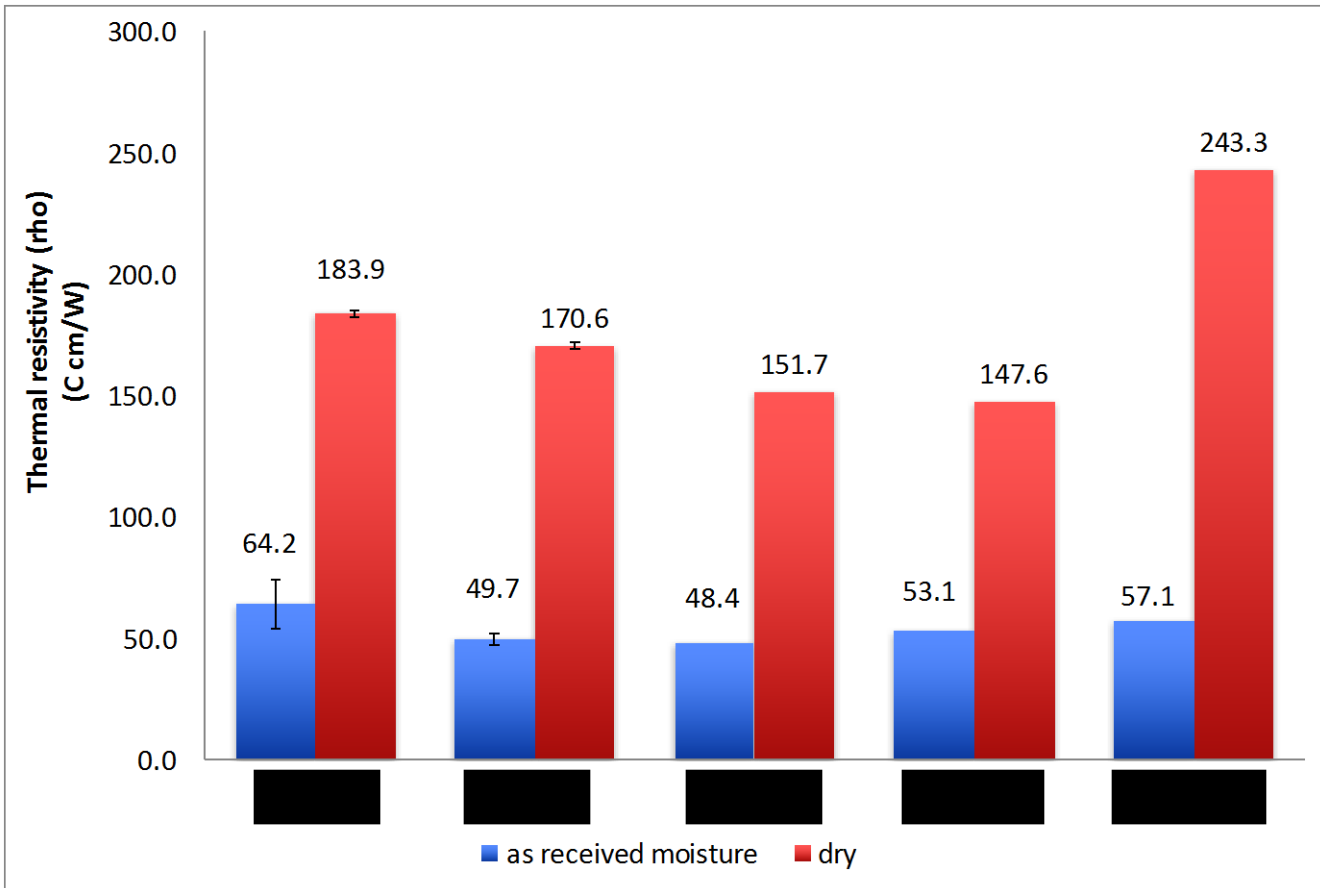


Figure 1. Measured thermal resistivity for the samples in SI units. The values represent the average of three measurements on each sample, and the error bars represent  $\pm 1$  standard deviation.

Please don't hesitate to contact me with questions or comments.

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