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June 1, 2018

ASTM D5334 Thermal Dryout Curve Testing Results June 2018

Thermal dryout curves were generated by METER [Thermal Properties Testing Services](#) on six soil/gravel samples received from _____ under RMA _____. Thermal resistivity (ρ) measurements were conducted at as-received, wet, and oven dry water contents using the [TEMPOS](#) thermal properties analyzer with the TR-3 sensor in accordance with ASTM D5334. For the moist material measurements, the TEMPOS was configured in high power mode with a 5 minute read time. For the dry condition, the TEMPOS was configured in high power mode with a 10 minute read time, and thermal grease was used to prevent the effects of thermal contact resistance between the sensor and the samples. The accuracy of the TR-3 sensors and associated TEMPOS units was verified using a Delrin plastic verification cylinder before the measurements on the samples. All measurements were performed at room temperature.

Thermal dryout curves were interpolated between the oven dry and saturated water content points using the combination method described in the Application Note titled [“Producing Thermal Dryout Curves for Buried Cable Applications.”](#)

Measured and interpolated data are shown in the following tables and graphs.

SAMPLE INFORMATION

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Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.08	0.29
Water Content (% mass)	0%	8%	29%
VWC (m3/m3)	0.00	0.13	0.46
VWC (%)	0%	13%	46%
Dry Bulk Density (g/cm3)	1.57	1.57	1.57
Dry Unit wt. (pcf)	98.0	98.0	98.0
Total Porosity (%)	46%	46%	46%
Measured Thermal Conductivity (W/m K)	0.676	0.983	1.615
Measured Rho (C cm/W)	148.0	101.7	61.9
Standard Deviation Rho (C cm/W)	1.2	7.2	5.4

Table 1. Measured thermal and physical values for sample <intentionally left blank>



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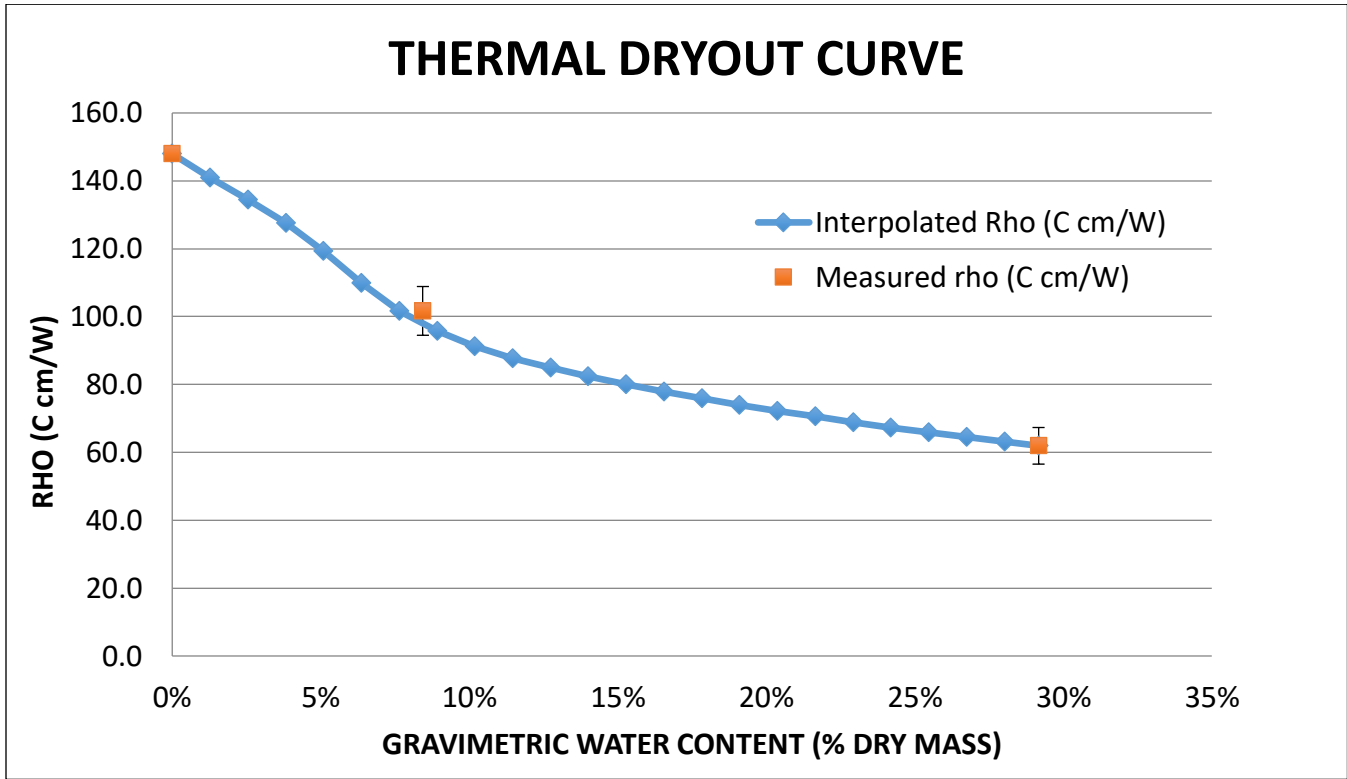


Figure 1. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.12	0.28
Water Content (% mass)	0%	12%	28%
VWC (m3/m3)	0.00	0.16	0.39
VWC (%)	0%	16%	39%
Dry Bulk Density (g/cm3)	1.40	1.40	1.40
Dry Unit wt. (pcf)	87.6	87.6	87.6
Total Porosity (%)	47%	47%	47%
Measured Thermal Conductivity (W/m K)	0.663	1.597	2.144
Measured Rho (C cm/W)	150.7	62.6	46.6
Standard Deviation Rho (C cm/W)	14.4	7.4	2.8

Table 2. Measured thermal and physical values for sample <intentionally left blank>



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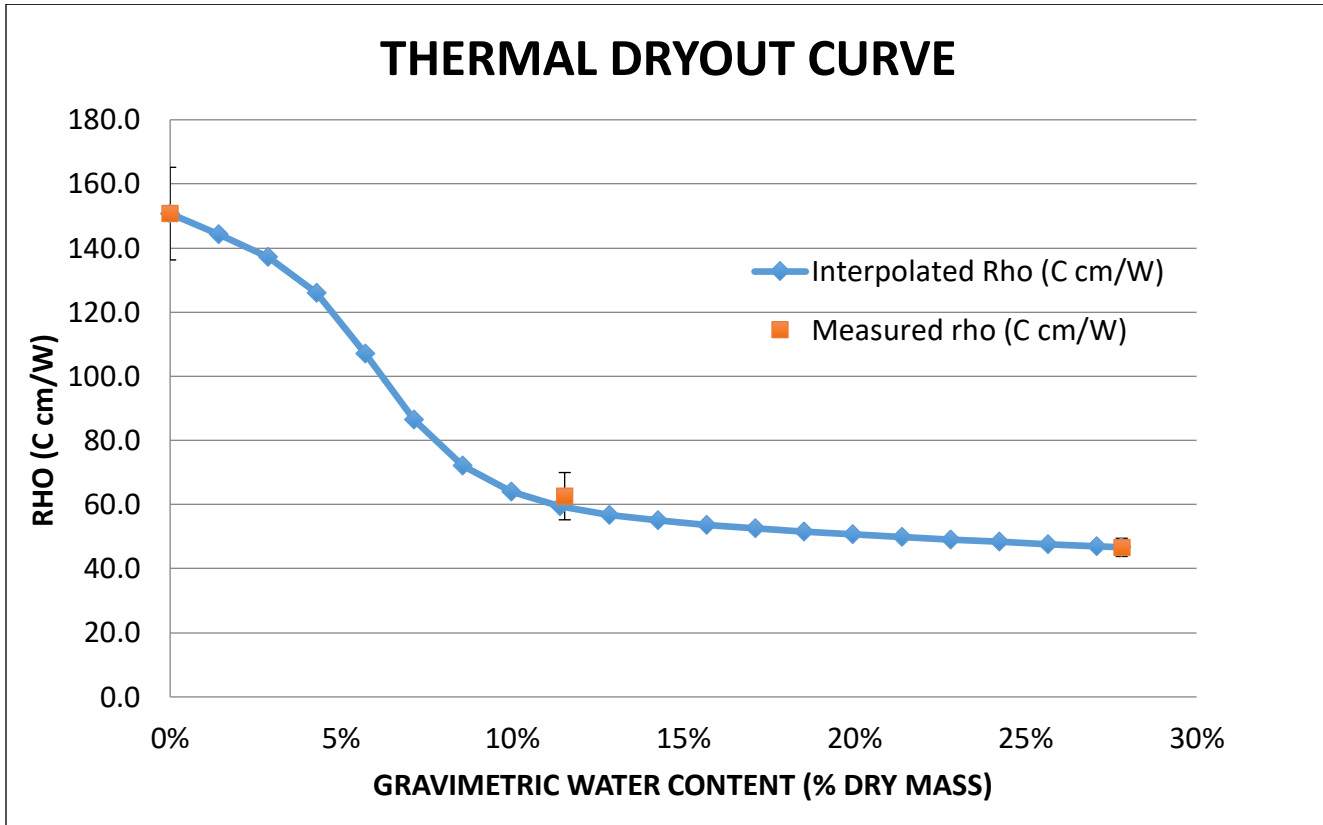


Figure 2. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.12	0.27
Water Content (% mass)	0%	12%	27%
VWC (m3/m3)	0.00	0.18	0.42
VWC (%)	0%	18%	42%
Dry Bulk Density (g/cm3)	1.54	1.54	1.54
Dry Unit wt. (pcf)	96.4	96.4	96.4
Total Porosity (%)	42%	42%	42%
Measured Thermal Conductivity (W/m K)	0.677	1.216	1.663
Measured Rho (C cm/W)	147.7	82.2	60.1
Standard Deviation Rho (C cm/W)	3.2	10.8	3.7

Table 3. Measured thermal and physical values for sample <intentionally left blank>



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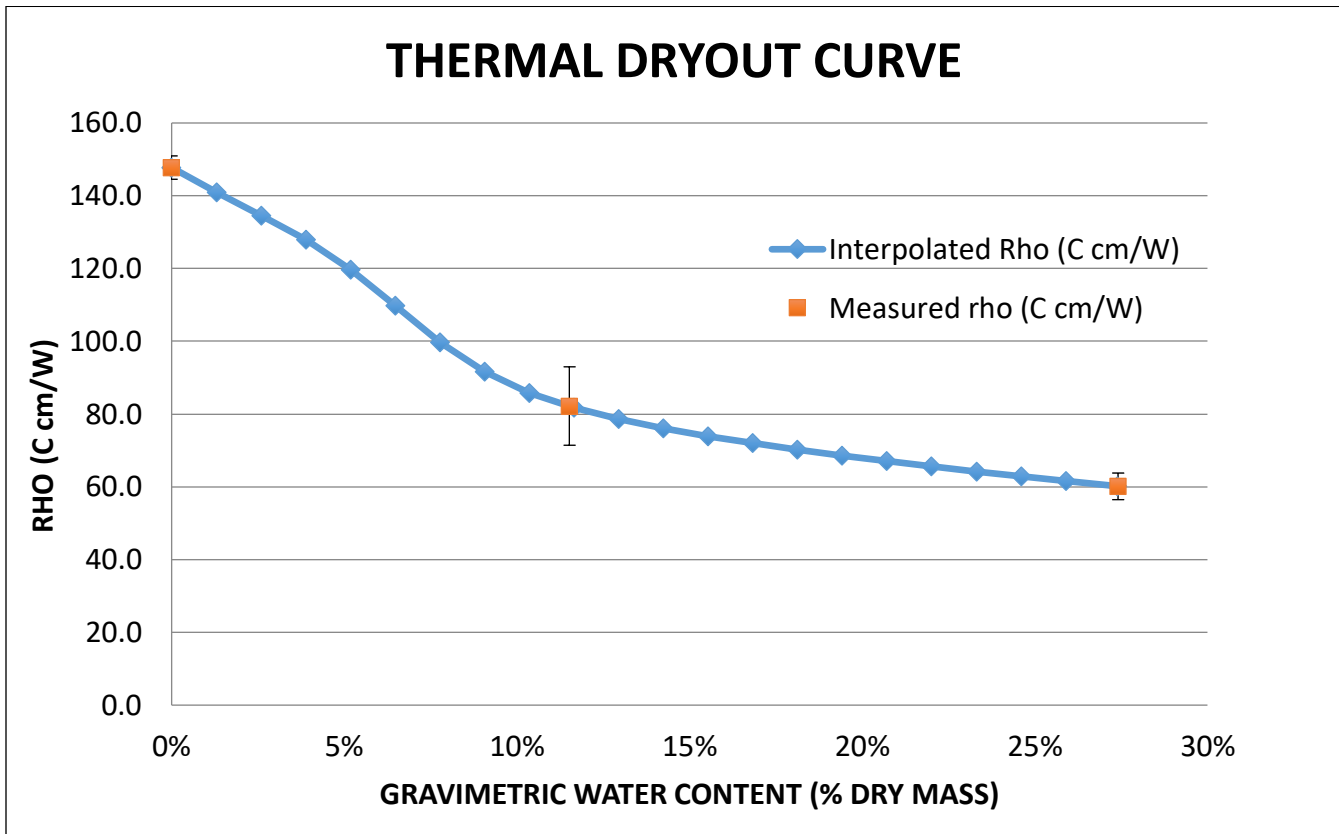


Figure 3. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate \pm one standard deviation in the three measurements made at each water content level.

Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.13	0.19
Water Content (% mass)	0%	13%	19%
VWC (m3/m3)	0.00	0.24	0.33
VWC (%)	0%	24%	33%
Dry Bulk Density (g/cm3)	1.80	1.80	1.80
Dry Unit wt. (pcf)	112.1	112.1	112.1
Total Porosity (%)	33%	33%	33%
Measured Thermal Conductivity (W/m K)	0.635	1.528	1.758
Measured Rho (C cm/W)	157.4	65.4	56.9
Standard Deviation Rho (C cm/W)	16.6	11.0	12.1

Table 4. Measured thermal and physical values for sample <intentionally left blank>



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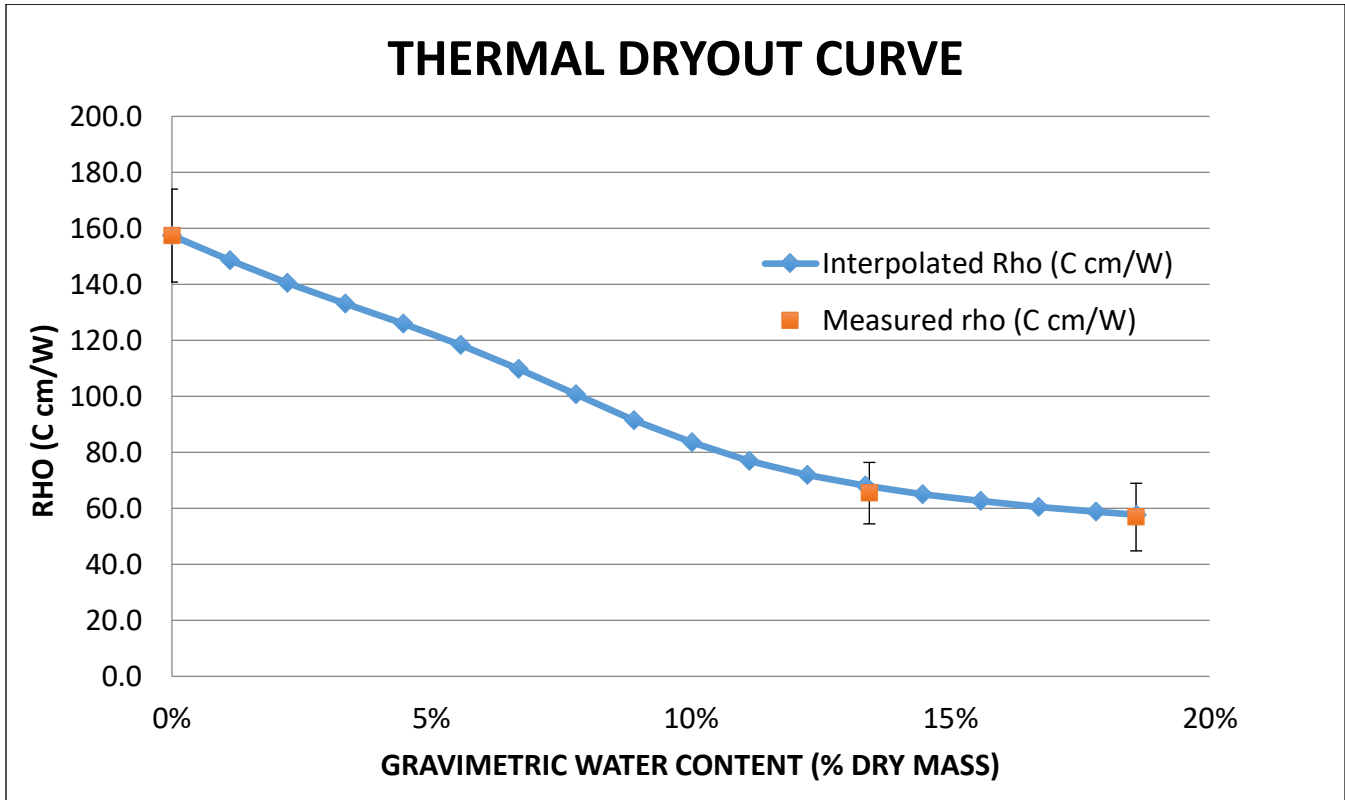


Figure 4. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.10	0.21
Water Content (% mass)	0%	10%	21%
VWC (m3/m3)	0.00	0.17	0.36
VWC (%)	0%	17%	36%
Dry Bulk Density (g/cm3)	1.70	1.70	1.70
Dry Unit wt. (pcf)	106.2	106.2	106.2
Total Porosity (%)	36%	36%	36%
Measured Thermal Conductivity (W/m K)	0.579	1.674	1.995
Measured Rho (C cm/W)	172.7	59.7	50.1
Standard Deviation Rho (C cm/W)	21.6	15.7	5.6

Table 5. Measured thermal and physical values for sample <intentionally left blank>



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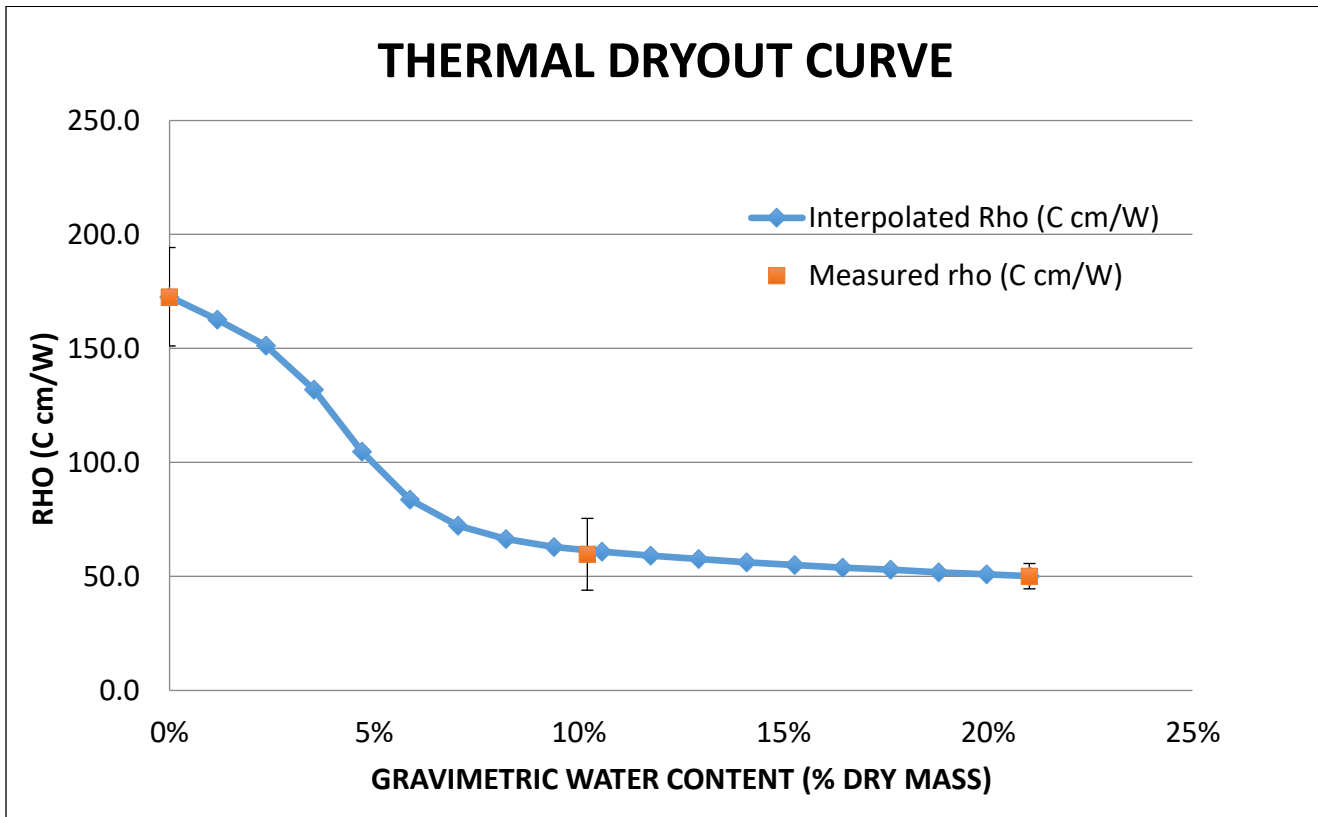


Figure 5. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate ± one standard deviation in the three measurements made at each water content level.

Sample Condition	Oven Dry	Native	Wet
Water Content (g/g)	0.00	0.12	0.30
Water Content (% mass)	0%	12%	30%
VWC (m3/m3)	0.00	0.19	0.45
VWC (%)	0%	19%	45%
Dry Bulk Density (g/cm3)	1.49	1.49	1.49
Dry Unit wt. (pcf)	93.0	93.0	93.0
Total Porosity (%)	45%	45%	45%
Measured Thermal Conductivity (W/m K)	0.371	1.064	1.828
Measured Rho (C cm/W)	269.6	94.0	54.7
Standard Deviation Rho (C cm/W)	37.9	33.1	4.2

Table 6. Measured thermal and physical values for sample <intentionally left blank>



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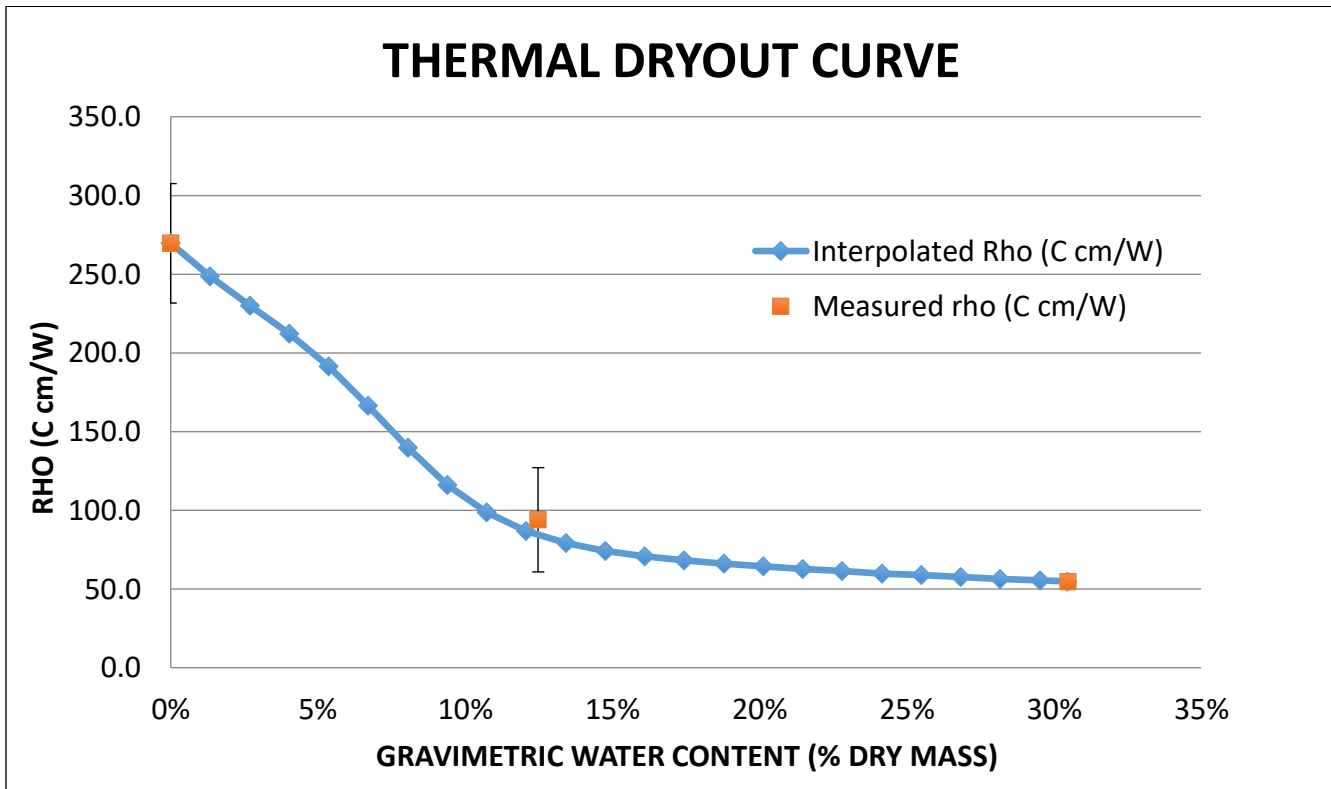


Figure 6. Thermal dryout curve for sample <intentionally left blank> with measured and interpolated thermal resistivity data. Error bars indicate \pm one standard deviation in the three measurements made at each water content level.



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

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