

Supplementary Information

Property Data Used in Hygrothermal Simulations

1. Interior Gypsum Board [1]

Table S1. Property data.

Property	Value
Thickness, mm	12.5
Bulk density, kg/m ³	600
Porosity, m ³ /m ³	0.706
Specific heat capacity (dry), J/(kg·K)	870
Thermal conductivity (dry, 10 °C), W/(m·K)	0.16
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Water vapor diffusion resistance factor	5.66 *

* based on measurements in this work

Table S2. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.505	4.34
0.71	6.16
0.896	11.3
0.99	93.0
1.0	430.6

2. Asphalt-Coated Kraft Paper [1,2]

Table S3. Property data.

Property	Value
Thickness, mm	1
Bulk density, kg/m ³	120
Porosity, m ³ /m ³	0.6
Specific heat capacity (dry), J/(kg·K)	1500
Thermal conductivity (dry, 10 °C), W/(m·K)	0.42
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S4. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.5	0.6
0.8	1.8
0.9	2.6
0.97	3.5
1.0	11.2

Table S5. Water vapor diffusion resistance factor (based on dry-cup and wet-cup measurements in this work).

RH	μ -Value	RH	μ -Value
0	5910	0.6	4389
0.1	5863	0.7	3605
0.2	5779	0.8	2720
0.3	5633	0.9	1879
0.4	5385	1.0	1202
0.5	4984	-	-

3. Glass Fiber Insulation [1,2]

Table S6. Property data.

Property	Value
Thickness, mm	89 or 140
Bulk density, kg/m ³	30
Porosity, m ³ /m ³	0.99
Specific heat capacity (dry), J/(kg·K)	840
Thermal conductivity (dry, 10 °C), W/(m·K)	0.035
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Water vapor diffusion resistance factor	1.3

4. Oriented Strand Board [1]

Table S7. Property data.

Property	Value
Thickness, mm	11
Bulk density, kg/m ³	650
Porosity, m ³ /m ³	0.95
Specific heat capacity (dry), J/(kg·K)	1880
Thermal conductivity (dry, 10 °C), W/(m·K)	0.092
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Reference water content, kg/m ³	83.3
Free water saturation, kg/m ³	470
Water absorption coefficient, kg/(m ² ·s ^{0.5})	0.0022

Table S8. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.494	43.55
0.693	59.15
0.895	104.65
0.998	407.55
1.0	470

Table S9. Water vapor diffusion resistance factor.

RH	μ -Value	RH	μ -Value
0	812.8	0.6	122.4
0.1	812.8	0.7	90.5
0.2	518.9	0.8	67.6
0.3	345.7	0.9	51.0
0.4	238.4	1.0	38.9
0.5	169.2	-	-

5. Conventional Spun-Bonded Polyolefin Membrane [1]

Table S10. Property data.

Property	Value
Thickness, mm	0.2
Bulk density, kg/m ³	448
Porosity, m ³ /m ³	0.001
Specific heat capacity (dry), J/(kg·K)	1500
Thermal conductivity (dry, 10 °C), W/(m·K)	2.4
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Water vapor diffusion resistance factor	328.4

6. Corrugated Spun-Bonded Polyolefin Membrane [1]

Table S11. Property data.

Property	Value
Thickness, mm	0.1
Bulk density, kg/m ³	638
Porosity, m ³ /m ³	0.001
Specific heat capacity (dry), J/(kg·K)	1500
Thermal conductivity (dry, 10 °C), W/(m·K)	2.4
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Water vapor diffusion resistance factor	625.2

7. Bituminous Paper (#15 Felt) [1]

Table S12. Property data.

Property	Value
Thickness, mm	0.7
Bulk density, kg/m ³	715
Porosity, m ³ /m ³	0.001
Specific heat capacity (dry), J/(kg·K)	1500
Thermal conductivity (dry, 10 °C), W/(m·K)	4.0
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S13. Water vapor diffusion resistance factor.

RH	μ -Value	RH	μ -Value
0	993.2	0.7	726.2
0.1	993.1	0.8	497.4
0.5	993.1	0.9	247.0
0.6	979.7	1.0	92.9

8. Extruded Polystyrene Insulation [1]

Table S14. Property data.

Property	Value
Thickness, mm	25
Bulk density, kg/m ³	27*
Porosity, m ³ /m ³	0.99
Specific heat capacity (dry), J/(kg·K)	1470
Thermal conductivity (dry, 10 °C), W/(m·K)	0.028
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Water vapor diffusion resistance factor	128.4 *

* based measurements in this work

Table S15. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.1	0.009
0.5	0.08
0.8	0.31
0.9	0.66
0.97	1.95
0.99	3.94
0.999	7.09
1.0	7.77

9. Manufactured Stone Veneer

Table S16. Properties are based on Regular Portland Stucco from North America Database [2] except where indicated.

Property	Value
Thickness, mm	46
Bulk density, kg/m ³	1600 [3]
Porosity, m ³ /m ³	0.225
Specific heat capacity (dry), J/(kg·K)	840
Thermal conductivity (dry, 10 °C), W/(m·K)	0.4
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S17. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.5	79.4
0.7	88.0
0.9	125.15
1.0	215.1

Table S18. Liquid transport coefficient.

Water Content, kg/m ³	<i>D</i> (Suction), m ² /s	<i>D</i> (Redistribution), m ² /s
0	0	0
50	1.41×10^{-13}	1.41×10^{-14}
70	4.80×10^{-13}	4.80×10^{-14}
90	1.63×10^{-12}	1.63×10^{-13}
120	1.02×10^{-11}	1.02×10^{-12}
160	1.18×10^{-10}	1.18×10^{-11}
220	4.64×10^{-9}	4.64×10^{-10}

Table S19. Water vapor diffusion resistance factor (based on dry-cup and wet-cup measurements from [3]).

RH	μ-Value	RH	μ-Value
0	63.3	0.6	45.6
0.1	62.6	0.7	37.6
0.2	61.5	0.8	28.9
0.3	59.6	0.9	20.6
0.4	56.6	1.0	13.8
0.5	52.0	-	-

10. Regular Portland Stucco [2]

Table S20. Property data.

Property	Value
Thickness, mm	14
Bulk density, kg/m ³	1956
Porosity, m ³ /m ³	0.225
Specific heat capacity (dry), J/(kg·K)	840
Thermal conductivity (dry, 10 °C), W/(m·K)	0.4
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S21. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.5	79.4
0.7	88.0
0.9	125.15

Table S22. Liquid transport coefficient.

Water Content, kg/m ³	<i>D</i> (Suction), m ² /s	<i>D</i> (Redistribution), m ² /s
0	0	0
50	1.41×10^{-13}	1.41×10^{-14}
70	4.80×10^{-13}	4.80×10^{-14}
90	1.63×10^{-12}	1.63×10^{-13}
120	1.02×10^{-11}	1.02×10^{-12}
160	1.18×10^{-10}	1.18×10^{-11}
220	4.64×10^{-9}	4.64×10^{-10}

Table S23. Water vapor diffusion resistance factor.

RH	μ-Value	RH	μ-Value
0	355.7	0.6	99.1
0.1	355.7	0.7	86.3
0.2	235.1	0.8	76.5
0.3	174.9	0.9	68.7
0.4	139.7	1.0	62.3
0.5	115.6	-	-

11. Cedar Siding

Table S24. Property data are for Western red cedar from [1] except where indicated.

Property	Value
Thickness, mm	11 ^a
Bulk density, kg/m ³	336 *
Porosity, m ³ /m ³	0.8
Specific heat capacity (dry), J/(kg·K)	1880
Thermal conductivity (dry, 10 °C), W/(m·K)	0.085
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002
Reference water content, kg/m ³	33.7
Free water saturation, kg/m ³	450.0
Water absorption coefficient, kg/(m ² ·s ^{0.5})	0.0007

^a Average thickness of bevel siding; * measured in this work.

Table S25. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.499	7.7
0.703	26.25
0.886	40.25
0.9978	395.5
1.0	450.0

Table S26. Water vapor diffusion resistance factor (based on dry-cup and wet-cup measurements in this work).

RH	μ -Value	RH	μ -Value
0	419	0.6	147
0.1	401	0.7	95.9
0.2	372	0.8	58.9
0.3	330	0.9	34.8
0.4	274	1.0	20.0
0.5	209	-	-

11. Vinyl Siding

Thickness: 1.1 mm. This cladding was simulated using an equivalent vapor permeance, which is a simple method of modeling a cladding that is vapor impermeable but is back-ventilated by airflow. The equivalent vapor permeance was selected as 2300 ng/(Pa·s·m²) (40 perms) based on [4].

12. Brick Veneer [2]

Table S27. Property data.

Property	Value
Thickness, mm	102
Bulk density, kg/m ³	1670
Porosity, m ³ /m ³	0.196
Specific heat capacity (dry), J/(kg·K)	840
Thermal conductivity (dry, 10 °C), W/(m·K)	0.4
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S28. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.6	1.67
0.8	3.34
0.93	5.01
0.96	6.68
0.975	55.11
0.985	101.87
0.99	131.93
0.997	177.02
1.0	195.39

Table S29. Liquid transport coefficient.

Water Content, kg/m ³	<i>D</i> (Suction), m ² /s	<i>D</i> (Redistribution), m ² /s
0	0	0
3.34	1.1×10^{-8}	1.1×10^{-9}
5.01	2.8×10^{-8}	2.8×10^{-9}
55.11	3.56×10^{-7}	3.56×10^{-8}
101.87	6.56×10^{-7}	6.56×10^{-8}
177.02	1.35×10^{-6}	1.35×10^{-7}
195.39	2.5×10^{-6}	2.5×10^{-7}

Table S30. Water vapor diffusion resistance factor.

RH	μ -Value
0	16.0
0.1	15.39
0.9	6.68
0.98	4.85

Table S31. Thermal conductivity, moisture dependence.

Water Content, kg/m ³	Thermal Conductivity (10 °C), W/(m·K)
0	0.4
196	0.776

13. Fiber Cement Siding

Table S32. Property data are for fiber cement sheathing board from [1].

Property	Value
Thickness, mm	8
Bulk density, kg/m ³	1380
Porosity, m ³ /m ³	0.479
Specific heat capacity (dry), J/(kg·K)	840
Thermal conductivity (dry, 10 °C), W/(m·K)	0.245
Thermal conductivity temperature coefficient, W/(m·K ²)	0.0002

Table S33. Moisture storage function.

RH	Water Content, kg/m ³
0	0
0.506	73.14
0.705	125.58
0.903	251.16
0.9993	467.82
1.0	470

Table S34. Liquid transport coefficient.

Water Content, kg/m ³	<i>D</i> (Suction), m ² /s	<i>D</i> (Redistribution), m ² /s
0	0	0
40	1.04×10^{-10}	1.04×10^{-11}
70	1.88×10^{-10}	1.88×10^{-11}
100	3.42×10^{-10}	3.42×10^{-11}
160	1.13×10^{-9}	1.13×10^{-10}
240	5.57×10^{-9}	5.57×10^{-10}
307.7	2.16×10^{-8}	2.16×10^{-9}

Table S35. Water vapor diffusion resistance factor.

RH	μ-Value	RH	μ-Value
0	990.9	0.6	75.4
0.1	990.9	0.7	44.2
0.2	596.2	0.8	25.3
0.3	357.5	0.9	14.1
0.4	213.6	1.0	7.2
0.5	127.7	-	-

References

1. Kumaran, M.K.; Lackey, J.C.; Normandin, N.; Tariku, F.; van Reenen, D. *A Thermal and Moisture Transport Property Database for Common Building and Insulating Materials: Final Report from ASHRAE Research Project 1018-RP*; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.: Atlanta, GA, USA, 2002.
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