Table 2.1 Typical Thermal Properties of Common Building Materials—Design Value a

Description					Resistance ^c (R)	
Asbestos-cement board 120 4.0 - 0.25 - Asbestos-cement board 0.25 in. 120 - 16.50 - 0.06 Gypsum or plaster board 0.5 in. 50 - 2.22 - 0.45 Plywood (Douglas fir) 0.375 in. 34 - 0.80 - 1.25 - Plywood (Douglas fir) 0.575 in. 34 - 1.60 - 0.62 Plywood (Douglas fir) 0.525 in. 34 - 1.60 - 0.62 Plywood (Douglas fir) 0.625 in. 34 - 1.60 - 0.62 Plywood (Douglas fir) 0.625 in. 34 - 1.29 - 0.77 Vegetable fiber board Shacthing, regular density, 0.5 in. 18 - 1.06 - 0.94 Sbachting, regular density, 0.5 in. 18 - 1.06 - 0.94 Sound deadening board 0.5 in. 15 - 0.74 - 1.35 Tile & lay-in panels, plain or acoustic 18 0.40 - 2.50 - 1.25 0.75 in. 18 - 0.80 - 1.25 0.75 in. 18 - 0.80 - 1.25 0.75 in. 18 - 0.80 - 1.25 0.75 in. 18 - 0.53 - 1.37 - 1.47 High-density, service-tempered grade & service grade 55 0.82 - 1.22 - - Heigh-density, service-tempered grade & service grade 55 0.82 - 1.22 - Braticleboard* Medium density 50 0.94 - 1.06 - High density 50 0.94 - 1.06 - High density 62.5 1.18 - 0.85 - Underlayment, 0.625 in. 40 - 1.22 - 0.82 Wood subfloor, 0.75 in. - 1.06 - 0.94 Wood subfloor, 0.75 in. - - 0.94 BULLDING MEMBRANE Vapor-permeable felt - - 8.35 - 0.12 Vapor-seal, plastic film - - 8.35 - 0.12 Vapor-seal, 2 layers of mopped 15-15 felt - - 0.48 - 2.08 Carpet & fibrous pad - 0.06 Vapor-seal, plastic film - 1.23 Cork tile, 0.125 in. - 0.06 Nood, hardwood finish, 0.75 in. - 1.47 - 0.68 HINSH FLOORING MATERIALS Blanket and batt* Blanket and batt* Blanket and batt* Blanket and batte and ba	Description		(k), Btu-in./	(C), Btu/	Thickness (1/k), °F-ft²-h/	Thickness Listed (1/C), °F-ft²-h/
Asbestos-cement board, 0.25 in. 120	BUILDING BOARD					
Gypsum or plaster board, 0.5 in. 50 — 2.22 — 0.45 Plywood (Douglas fir), 0.375 in. 34 — 1.13 — 0.47 Plywood (Douglas fir), 0.5 in. 34 — 1.60 — 0.62 Plywood (Douglas fir), 0.5 in. 34 — 1.29 — 0.77 Vegetable fiber board Shathing, regular density, 0.5 in. 18 — 0.76 — 1.32 Sheathing, regular density, 0.5 in. 18 — 0.76 — 1.32 Sheathing, regular density, 0.5 in. 18 — 0.76 — 1.32 Sheathing, regular density, 0.5 in. 18 — 0.74 — 1.35 Shingle backer, 0.375 in. 18 — 0.74 — 1.35 Tile & lay-in panels, plain or a 0.80 — 1.25 — 0.5 in. 18 — 0.80 — 1.25 — 0.25 — 1.25 — 1.25 — 0.25 <td>Asbestos-cement board</td> <td>120</td> <td>4.0</td> <td>_</td> <td>0.25</td> <td>_</td>	Asbestos-cement board	120	4.0	_	0.25	_
Plywood (Douglas fir) 34	Asbestos-cement board, 0.25 in.	120	_	16.50	_	0.06
Plywood (Douglas fir), 0.375 in. 34		50	_	2.22		0.45
Plywood (Douglas fir), 0.5 in. 34			0.80		1.25	
Plywood (Douglas fir), 0.625 in. 34			_		_	
Vegetable fiber board 18 — 0.76 — 1.32 Sheathing, regular density, 0.5 in. 18 — 1.06 — 0.94 Sound deadening board, 0.5 in. 15 — 0.74 — 1.35 Tile & lay-in panels, plain or acoustic 18 0.40 — 2.50 — 0.5 in. 18 — 0.80 — 1.25 0.75 in. 18 — 0.53 — 1.29 Hardboard* — 0.53 — 1.89 Hardboard* — 0.53 — 1.89 Hardboard* — 0.53 — 1.22 — Medium density 50 0.73 — 1.37 — High-density, service-tempered grade 55 0.82 — 1.22 — Particleboard* Medium density 60 0.94 — 1.06 — High density 60 0.94 — 1.06 — <t< td=""><td></td><td></td><td></td><td></td><td>-</td><td></td></t<>					-	
Shingle backer, 0.375 in. 18 — 1.06 — 0.94 Sound deadening board, 0.5 in. 15 — 0.74 — 1.35 Tile & lay-in panels, plain or acoustic 18 0.40 — 2.50 — 0.5 in. 18 — 0.80 — 1.25 0.75 in. 18 — 0.53 — 1.89 Hardboard* Medium density 50 0.73 — 1.37 — High-density, service-tempered grade & service grade 55 0.82 — 1.22 — Particleboard* Medium density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.06 — 0.94 High density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.06 — 0.94 BUILDING MEMBRANE Vapor—seal, 2 layers of mopped 15-lb felt — 8.35 — 0.12 Vapor—seal, 2 layers of mopped 15-lb felt — — 8.35 — 0.12 Vapor—seal, plastic film — — 8.35 — 0.12 Vapor—seal, plastic film — — 0.88 — 0.28 Carpet & rubber pad — 0.48 — 2.08 Carpet & rubber pad — 0.81 — 1.23 Cork tile, 0.125 in. — 3.60 — 0.28 Terrazzo, 1 in. — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — 1.47 — 0.68 HINSULATING MATERIALS Blanket and batt* Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3-4 in. 1.2-1.6 — 0.067 — 15 approx. 3-5 in. 0.4-2.0 — 0.095 — 19 approx. 5-5-6.5 in. 0.4-2.0 — 0.0053 — 19 approx. 5-5-6.5 in. 0.4-2.0 — 0.0053 — 19 approx. 5-7.6 in. 0.4-2.0 — 0.0045 — 22 approx. 3-2 in. 0.4-2.0 — 0.0045 — 22 approx. 3-2 in. 0.4-2.0 — 0.0045 — 22 approx. 3-5 in. 0.4-2.0 — 0.0045 — 22 approx. 3-5 in. 0.4-2.0 — 0.0045 — 22 approx. 3-6 in. 0.4-2.0 — 0.0045 — 22 approx. 3-7 in. 0.4-2.0 — 0.0045 — 22 approx. 3-8 in. 0.4-2.0 — 0.0045 — 22 approx. 3-6 in. 0.4-2.0 — 0.0045 — 22 approx. 3-7 in. 0.4-2.0 — 0.0045 — 22 approx. 3-8 in. 0.4-2.0 — 0.0045 — 22 approx. 3-8 in. 0.4-2.0 — 0.0045 — 23 approx. 3-6 in. 0.4-2.0 — 0.0045 — 38 Board and Slabs	Vegetable fiber board				_	
Sound deadening board, 0.5 in. 15					_	
Tile & lay-in panels, plain or acoustic 18 0.40 — 2.50 — 1.25 0.51 in. 18 — 0.80 — 1.25 0.75 in. 18 — 0.53 — 1.89 Hardboard* Medium density 50 0.73 — 1.37 — 1.37 — High-density, service-tempered grade & service grade 55 0.82 — 1.22 — Particleboard* Medium density 50 0.94 — 1.06 — High density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. 40 — 1.06 — 0.94 MULDING MEMBRANE Vapor—permeable felt — 4 — 16.70 — 0.06 Vapor—seal, 2 layers of mopped 15-lb felt — 4 — 8.35 — 0.12 Vapor—seal, plastic film — 4 — 0.85 — Negl. FINISH FLOORING MATERIALS Carpet & fibrous pad — 4 0.81 — 1.23 Cork tile, 0.125 in. — 3.60 — 0.28 Cork tile, 0.125 in. — 4 0.81 — 1.23 Cork tile, 0.125 in. — 4 12.50 — 0.08 Increased in the cork of the cork o			_		_	
acoustic 18 0.40 — 2.50 — 1.25 0.51 in. 18 — 0.80 — 1.25 0.75 in. 18 — 0.53 — 1.89 Hardboard* Medium density 50 0.73 — 1.37 — 1.37 — 1.89 High-density, service-tempered grade & service grade 55 0.82 — 1.22 — Particleboard* Medium density 50 0.94 — 1.06 — 1.06 — High density 62.5 1.18 — 0.85 — 0.85 — 1.22 — 0.82 Wood subfloor, 0.75 in. 40 — 1.22 — 0.85 — 0.94 BUILDING MEMBRANE Vapor—permeable felt — 1.06 — 1.06 — 0.94 Uspor—seal, 2 layers of mopped 15-1b felt — 8.35 — 0.12 Vapor—seal, 2 layers of mopped 15-1b felt — 1.06 — 0.06 Vapor—seal, 2 layers of mopped 15-1b felt — 1.06 — 0.06 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—seal, 1.20 — 0.09 Vapor—seal, 1.20 — 0.08 Vapor—		15		0.74	_	1.35
0.5 in. 18		10	0.40		2.50	
0.75 in. 18			0.40		2.50	1.25
Hardboard Medium density S0 0.73 — 1.37 — High-density, service-tempered grade & service grade S5 0.82 — 1.22 — Particleboard Medium density S0 0.94 — 1.06 — High density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. — 1.06 — 1.06 — 0.94 Medium density S0 0.94 — 1.06 — 0.85 — Underlayment, 0.625 in. 40 — 1.06 — 0.85 — Underlayment, 0.625 in. — — 1.06 — 0.82 Mod subfloor, 0.75 in. — — 1.06 — 0.84 — 0.85 — 0.10 MemBrane Modern Membrane Modern Membrane			_		_	
Medium density		10		0.55	_	1.09
High-density, service tempered grade & service grade \ 55 \ 0.82 \ — \ 1.22 \ — \ Particleboards \ Medium density \ 50 \ 0.94 \ — \ 1.06 \ — \ High density \ 62.5 \ 1.18 \ — \ 0.85 \ — \ 0.85 \ — \ Underlayment, 0.625 in. \ 40 \ — \ 1.06 \ — \ 1.06 \ — \ 0.94 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		50	0.73		1 37	
grade & service grade Particleboard* Medium density 50 0.94 — 1.06 — 1.06 — 1.07 High density 62.5 1.18 — 0.85 — 0.82 Wood subfloor, 0.75 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. BUILDING MEMBRANE Vapor—permeable felt Vapor—seal, 2 layers of mopped 15-lb felt 15-lb felt - 15-lb felt - 16.70 - 10.12 Vapor—seal, plastic film - 15-lore & B.35 - 0.12 Vapor—seal, plastic film - 15-lore & B.35 - 0.12 Vapor—seal, plastic film - 16.70 - 17.20 Negl. FINISH FLOORING MATERIALS Carpet & fibrous pad - 10.81 Cork tile, 0.125 in. - 11.250 - 0.08 Tile-asphalt, linoleum, vinyl, rubber - 10.85 Wood, hardwood finish, 0.75 in. INSULATING MATERIALS Blanket and batt* Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3-4 in. 12-1.6 12-1.6 13-1.21 14-1.22 15-1.23 15-1.24 15-1.25		30	0.13		1.57	-
Particleboard Medium density 50 0.94 — 1.06 — High density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. — — 1.06 — 0.94 BUILDING MEMBRANE Vapor—permeable felt — — — 16.70 — 0.06 Vapor—seal, 2 layers of mopped 15-lb felt — — 8.35 — 0.12 Vapor—seal, plastic film — — 8.35 — 0.12 Vapor—seal, plastic film — — — 8.35 — 0.12 Vapor—seal, plastic film — — 0.48 — 2.08 Carpet & fibrous pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 0.81 — 1.23 Cork tile, 0.125 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3.5 in. 1.2-1.6 — 0.067 — 11 approx. 3.5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.033 — 19 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 3.03 approx. 10-13 in. Board and Slabs Cellular glass 8.0 0.33 — 3.03 —		55	0.82	_	1.22	_
Medium density 50 0.94 — 1.06 — High density 62.5 1.18 — 0.85 — Underlayment, 0.625 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. — — 1.06 — 0.94 BUILDING MEMBRANE Vapor—sealel felt — — 16.70 — 0.06 Vapor—seal, 2 layers of mopped — — 8.35 — 0.12 Vapor—seal, plastic film — — — Negl. FINISH FLOORING MATERIALS Carpet & fibrous pad — — 0.48 — 2.08 Carpet & fibrous pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 0.81 — 1.23 Cork tile, 0.125 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 1.47 — 0.68					1.22	
High density 62.5 1.18 — 0.85 — 0.82 Underlayment, 0.625 in. 40 — 1.22 — 0.82 Wood subfloor, 0.75 in. — 1.06 — 1.06 — 0.94 BUILDING MEMBRANE Vapor—permeable felt — 16.70 — 0.06 Vapor—seal, 2 layers of mopped 15-lb felt — 16.70 — 0.06 Vapor—seal, plastic film — 15-lb felt — 16.70 — Negl. FINISH FLOORING MATERIALS Carpet & fibrous pad — 0.48 — 2.08 Carpet & rubber pad — 0.81 — 1.23 Cork tile, 0.125 in. — 3.60 — 0.28 Terrazzo, 1 in. Tile-asphalt, linoleum, vinyl, rubber — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — 12.50 — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3.5 in. 1.2—1.6 — 0.067 — 11 approx. 3.5 in. 0.4—2.0 — 0.053 — 19 approx. 5.5—6.5 in. 0.4—2.0 — 0.045 — 22 approx. 8.25—10 in. 0.4—2.0 — 0.033 — 30 approx. 10—13 in. 0.4—2.0 — 0.026 — 38 Board and Slabs Cellular glass 8.0 0.33 — 3.03 — 3.03		50	0.94		1.06	_
Wood subfloor, 0.75 in.		62.5				
National Registry Nati		40	_	1.22	_	0.82
Vapor—permeable felt	Wood subfloor, 0.75 in.	_	_	1.06	_	0.94
Vapor—permeable felt	BUILDING MEMBRANE					
Vapor—seal, 2 layers of mopped 15-lb felt				16.70	_	0.06
Vapor—seal, plastic film — — — Negl. FINISH FLOORING MATERIALS Carpet & fibrous pad — — 0.48 — 2.08 Carpet & rubber pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 3.60 — 0.28 Terrazzo, 1 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass Sapprox. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3.5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 6-7.6 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0<						
FINISH FLOORING MATERIALS Carpet & fibrous pad	15-lb felt	_	_	8.35	_	0.12
Carpet & fibrous pad — — 0.48 — 2.08 Carpet & rubber pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 3.60 — 0.28 Terrazzo, 1 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass — 1.47 — 0.68 Insulation fibrous form processed from rock, slag, or glass — — 0.091 — 11 approx. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3-5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 <td< td=""><td>Vapor—seal, plastic film</td><td>_</td><td>_</td><td>_</td><td>_</td><td>Negl.</td></td<>	Vapor—seal, plastic film	_	_	_	_	Negl.
Carpet & fibrous pad — — 0.48 — 2.08 Carpet & rubber pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 3.60 — 0.28 Terrazzo, 1 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass — 1.47 — 0.68 Insulation fibrous form processed from rock, slag, or glass — — 0.091 — 11 approx. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3-5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 <td< td=""><td>FINISH FLOORING MATERIALS</td><td></td><td></td><td></td><td></td><td></td></td<>	FINISH FLOORING MATERIALS					
Carpet & rubber pad — — 0.81 — 1.23 Cork tile, 0.125 in. — — 3.60 — 0.28 Terrazzo, 1 in. — — 12.50 — 0.08 Tile-asphalt, linoleum, vinyl, rubber — — 20.00 — 0.05 Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte — 0.04 — 0.68 INSULATING MATERIALS Blanket and batte — 0.091 — 11 approx. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3-4 in. 0.4-2.0 — 0.067 — 15 approx. 3.5 in. 0.4-2.0 — 0.053 — 19 approx. 6-7.6 in. 0.4-2.0 — 0.045 — 22 approx. 10-13 in. 0.4-2.0 — 0.026 — </td <td></td> <td>_</td> <td>_</td> <td>0.48</td> <td>_</td> <td>2.08</td>		_	_	0.48	_	2.08
Terrazzo, 1 in. — — — — — — — — — — — — — — — — — — —		_	_		_	
Tile-asphalt, linoleum, vinyl, rubber — — — — — — — — — — — — — — — — — — —	Cork tile, 0.125 in.	_		3.60	_	0.28
Wood, hardwood finish, 0.75 in. — — 1.47 — 0.68 INSULATING MATERIALS Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3.5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 6-7.6 in. 0.4-2.0 — 0.045 — 22 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 — 0.026 — 38 Board and Slabs Cellular glass 8.0 0.33 — 3.03 —		_		12.50	_	0.08
Sunstance Suns		_	_		_	
Blanket and batte Mineral fiber, fibrous form processed from rock, slag, or glass approx. 3-4 in. 0.4-2.0 — 0.091 — 11 approx. 3.5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 6-7.6 in. 0.4-2.0 — 0.045 — 22 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 — 0.026 — 38 Board and Slabs 8.0 0.33 — 3.03 —	Wood, hardwood finish, 0.75 in.	_	_	1.47	_	0.68
from rock, slag, or glass approx. 3–4 in. approx. 3.5 in. 1.2–1.6 approx. 5.5–6.5 in. 0.4–2.0 approx. 6–7.6 in. 0.4–2.0 approx. 8.25–10 in. 0.4–2.0 approx. 10–13 in. 0.4–2.0 Cellular glass 8.0 0.33 - 0.091 -	Blanket and batt ^e					
approx. 3.5 in. 1.2-1.6 — 0.067 — 15 approx. 5.5-6.5 in. 0.4-2.0 — 0.053 — 19 approx. 6-7.6 in. 0.4-2.0 — 0.045 — 22 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 — 0.026 — 38 Board and Slabs 8.0 0.33 — 3.03 —	from rock, slag, or glass	04.20		0.004		44
approx. 5.5–6.5 in. 0.4–2.0 — 0.053 — 19 approx. 6–7.6 in. 0.4–2.0 — 0.045 — 22 approx. 8.25–10 in. 0.4–2.0 — 0.033 — 30 approx. 10–13 in. 0.4–2.0 — 0.026 — 38 Board and Slabs 8.0 0.33 — 3.03 —					_	
approx. 6-7.6 in. 0.4-2.0 — 0.045 — 22 approx. 8.25-10 in. 0.4-2.0 — 0.033 — 30 approx. 10-13 in. 0.4-2.0 — 0.026 — 38 Board and Slabs Cellular glass 8.0 0.33 — 3.03 —					_	
approx. 8.25–10 in. 0.4–2.0 — 0.033 — 30 approx. 10–13 in. 0.4–2.0 — 0.026 — 38 Board and Slabs 8.0 0.33 — 3.03 —			_		_	
approx. 10–13 in. 0.4–2.0 — 0.026 — 38 Board and Slabs Cellular glass 8.0 0.33 — 3.03 —			_		_	
Board and Slabs Cellular glass 8.0 0.33 — 3.03 —			_			
Cellular glass 8.0 0.33 — 3.03 —		3 2.0		3.020		55
		8.0	0.33		3.03	_
		4.0 - 9.0	0.25	_		_

Table 2.1 (Continued)

Description	Density, lb/ft³	Conductivity ^b (k), Btu-in./ h-ft ² -°F	Conductance (C), Btu/ h-ft²-°F	Resistance ^c (R)	
				Per Inch Thickness (1/k), °F-ft²-h/ Btu-in.	For Thickness Listed (1/C), °F-ft²-h/ Btu
Expanded perlite, organic bonded	1.0	0.36	_	2.78	
Expanded polystyrene, molded beads	1.0	0.26	_	3.85	
	1.5	0.24		4.17	_
	2.0	0.23		4.35	
Mineral fiber with resin binder Mineral fiberboard, wet felted	15.0	0.29	_	3.45	_
Core or roof insulation	16–17	0.34	_	2.94	
Acoustical tile	18.0	0.35	_	2.86	_
Acoustical tile	21.0	0.37		2.70	_
Interior finish (plank, tile) Cement fiber slabs (shredded wood	15.0	0.35	_	2.86	_
with Portland cement binder) Loose Fill	25.0–27.0	0.50-0.53	_	2.0-1.89	_
Cellulosic insulation (milled paper					
or wood pulp)	2.3 - 3.2	0.27 - 0.32	_	3.70 - 3.13	_
Perlite, expanded	2.0-4.1	0.27 - 0.31		3.7 - 3.3	_
	4.1–7.4	0.31-0.36	_	3.3 - 2.8	_
M: 101 / 1 1 1 1 1	7.4 - 11.0	0.36 - 0.42	_	2.8 - 2.4	_
Mineral fiber (rock, slag or glass) ^e	0 (20				44.0
approx. 3.75–5 in.	$0.6-2.0 \\ 0.6-2.0$		-	_	11.0
approx. 6.5–8.75 in. approx. 10.25–13.75	0.6-2.0 $0.6-2.0$				19.0
Spray Applied	0.0-2.0			_	22.0 30.0
Polyurethane foam	1.5-2.5	0.16-0.18		6.25-5.56	
Cellulosic fiber	3.5-6.0	0.29-0.34	_	3.45-2.94	
Glass fiber	3.5–4.5	0.26-0.27	_	3.85-3.70	_
ROOFING					
Asbestos-cement shingles	120		4.76		0.21
Asphalt roll roofing	70		6.50		0.15
Asphalt shingles	70		2.27		0.44
Built-up roofing, 0.374 in.	70	_	3.00		0.33
Slate, 0.5 in.	_		20.00		0.05
Wood shingles, plain & plastic film faced	_	_	1.06	_	0.94
PLASTERING MATERIALS					
Cement plaster, sand aggregate	116	5.0		0.20	
Gypsum plaster: Lightweight aggregate, 0.5 in.	45	_	3.12	0.20	0.32
Lightweight aggregate on metal lath, 0.75 in.	13		2.13	_	
Perlite aggregate	45	1.5	2.13	0.67	0.47
Sand aggregate	105	5.6	_	0.18	
Sand aggregate on metal	103	5.0		0.10	
lath, 0.75 in.		_	7.70		0.13
Vermiculite aggregate	45	1.7	_	0.59	_
MASONRY MATERIALS					
Masonry Units					
Brick, fired clay	150	8.4-10.2	_	0.12-0.10	
	100	4.2-5.1	_	0.24-0.20	_
				0.40-0.33	

Table 2.1 (Continued)

				Resistance ^c (R)	
Description	Density, lb/ft ³	Conductivity ^b (k), Btu-in./ h-ft²-°F	Conductance (C), Btu/ h-ft²-°F	Per Inch Thickness (1/k), °F-ft²-h/ Btu-in.	For Thickness Listed (1/C), °F-ft²-h/ Btu
Concrete blocks					
Normal weight aggregate (sand & gravel) 8 in., 33–36 lb, 126–136 lb/ft ³ concrete, 2 or 3 cores Same with vermfilled cores 12 in., 50 lb, 125 lb/ft ³ concrete,	=	=	0.90-1.03 0.52-0.73		1.11-0.97 1.92-1.37
2 cores Lightweight aggregate (expanded shale, clay, slate or slag pumice) 6 in., 16–17 lb, 85–87 lb/ft ³ concrete,	_	_	0.81	_	1.23
2 or 3 cores		_	0.52 - 0.61	_	1.93 - 1.65
Same with perlite-filled cores	_	_	0.24	_	4.2
Same with vermfilled cores 8 in., 19–22 lb, 72–86 lb/ft ³	_	_	0.33	_	3.0
concrete		_	0.32 - 0.54	_	3.2 - 1.90
Same with perlite-filled cores	_	_	0.15 - 0.23	_	6.8 - 4.4
Same with vermfilled cores 12 in., 32–36 lb, 80–90 lb/ft ³ concrete,	_	_	0.19-0.26	_	5.3-3.9
2 or 3 cores	_	_	0.38 - 0.44	_	2.6 - 2.3
Same with vermfilled cores	_	_	0.17	_	5.8
Gypsum partition tile 3 by 12 by 30 in., solid Concretes	_	_	0.79	_	1.26
Sand & gravel or stone aggregate concretes Lightweight aggregate concretes Expanded shale, clay, or slate;	150	10.0–20.0	_	0.10-0.05	
expanded slags; cinders; pumice					_
(with density up to 100 lb/ft ³)	100	4.7-6.2	_	0.21-0.16	_
	80	3.3–4.1	_	0.30-0.24	_
Daulita recomminglita and	40	1.3		0.78	
Perlite, vermiculite, and polystyrene beads	50	1.8-1.9		0.55-0.53	
porystyrene beads				0.91	
Foam concretes	30 120	1.1 5.4		0.19	_
Toam concretes	80	3.0	_	0.33	_
Foam concretes and cellular	00	5.0		0.55	
concretes	40	1.4	_	0.71	
SIDING MATERIALS (on flat surface) <i>Shingles</i>					
Asbestos-cement Wood, plus insulation backer	120	_	4.75	_	0.21
board, 0.3125 in. Siding	_	_	0.71	_	1.40
Asbestos-cement, 0.25 in., lapped Asphalt insulating siding	_	_	4.76	_	0.21
(0.5 in. bed)	-	_	0.69	_	1.46
Wood, bevel, 0.5 × 8 in. lapped Aluminum or Steel g over sheathing	_	_	1.23	_	0.81
Insulating-board backed nominal 0.375 in.	_	_	0.55	_	1.82

Table 2.1 (Continued)

				Resistance ^c (R)	
Description	Density, lb/ft³	Conductivity ^b (k), Btu-in./ h-ft²-°F	Conductance (C), Btu/ h-ft ² -°F	Per Inch Thickness (1/k), °F-ft²-h/ Btu-in.	For Thickness Listed (1/C), °F-ft²-h/ Btu
Insulating-board backed nominal 0.375 in., foil backed Architectural (soda-lime float) glass	 158	6.9	0.34	_	2.96
WOODS (12% moisture content) Hardwoods	100	0.7		_	_
Oak	41.2-46.8	1.12-1.25	_	0.89-0.80	
Birch	42.6-45.4	1.16 - 1.22	_	0.87-0.82	
Maple	39.8-44.0	1.09 - 1.19	_	0.92-0.84	_
Ash Softwoods	38.4–41.9	1.06-1.14	_	0.94-0.88	_
Southern pine	35.6-41.2	1.00 - 1.12	_	1.00-0.89	_
Douglas fir-larch	33.5-36.3	0.95 - 1.01		1.06-0.99	_
Southern cypress	31.4-32.1	0.90 - 0.92	_	1.11-1.09	_
Hem-fir, spruce-pine-fir	24.5-31.4	0.74 - 0.90	_	1.35–1.11	_
West Coast woods, cedars	21.7-31.4	0.68 - 0.90	_	1.48-1.11	_
California redwood	24.5-28.0	0.74 - 0.82	_	1.35-1.22	_

^aValues are for a mean temperature of 75°F (24°C). Representative values for dry materials are intended as design (not specification) values for materials in normal use. For properties of a particular product, use the value supplied by the manufacturer or by unbiased tests.

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common insulating material and a common construction material. See also Table 2.2 for a summary of the terms that relate to heat transfer by conduction.

2.3 Convection

As described in Section 1.8, convection is a heat transfer mechanism that relies on fluid flow to carry the heat from one place to another. Although convective currents can occur in any fluid, convective heat transfer in building work is caused by air movement. The basic natural, or free convective flow is illustrated in Figure 1.5. (Forced convection,

as illustrated in Figure 1.6, is not under discussion here.) This same natural convection occurs at a cold window in a heated room. See Figure 2.3 (a). The cold outside air reduces the temperature of the inside surface of the window (by conduction). This in turn cools the layer of air immediately adjacent to the window, making it heavier than the warm room air. As a result, it drops towards the floor and is replaced by warm room air. This air in turn is cooled and falls, thus creating a convective air current, as shown. (For this reason, heaters are placed below windows—to reheat the cold air dropping from them. This practice prevents what can be a quite strong and unpleasant cold "draft" on a cold day from a single-glazed window.)

^bTo obtain thermal conductivities in Btuh-ft-°F, divide the K-factor by 12 in./ft.

^cResistance values are the reciprocals of *C* before rounding off *C* to two decimal places.

^dDoes not include paper backing and facing, if any. Where insulation forms a boundary (reflective or otherwise) of an air space, see Tables 2.3 and 2.6 for insulating value of an air space with the appropriate effective emittance and temperature conditions of the space. ^eConductivity varies with fiber diameter. Batt, blanket, and loose-fill mineral fiber insulations are manufactured to achieve specified R-values, the most common of which are listed here.

fInsulating values of acoustical tile vary, depending on density of the board and on type, size, and depth of perforations.

^gValues for metal siding applied over flat surfaces vary widely.