Part I

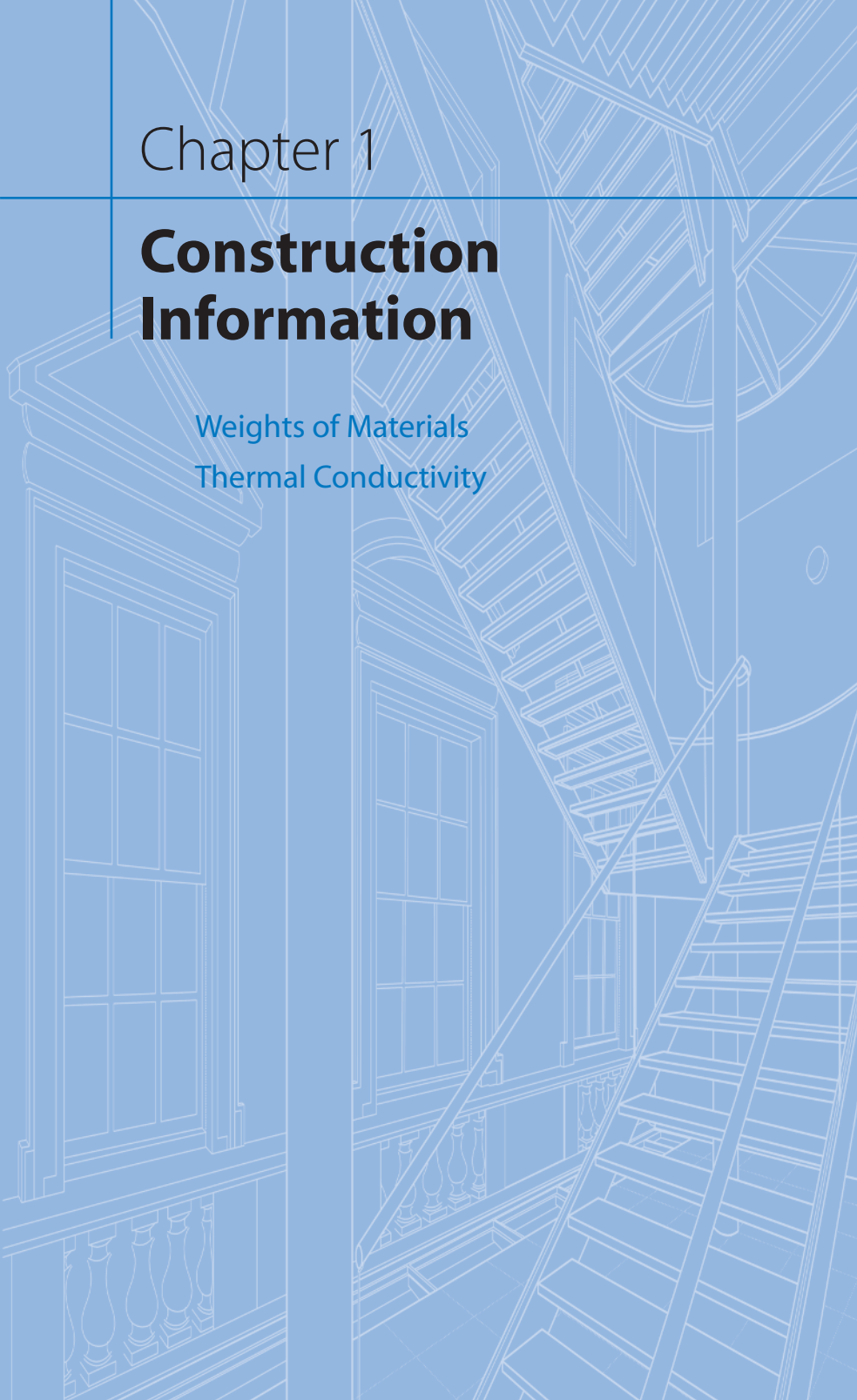
General Requirements

Chapter 1

Construction Information

Weights of Materials

Thermal Conductivity



Weights of Materials

Description

Table 1.1 provides weights of some common materials used in residential construction. Many times when in the field, changes are required, and the variation in weight of the material may need to be taken into consideration. Because of the infinite possibilities, the table provides only a sampling of common materials, and should be used only for rules of thumb. Once the actual product is selected, a final evaluation related to weight and the relationship to the structure and supporting elements should occur.

Table 1.1 Weight of Common Building Materials

Brick and Block Masonry		
4-in. brick		40 PSF
4-in. concrete block, stone or gravel		34 PSF
4-in. concrete block, lightweight		22 PSF
4-in. concrete brick, stone or gravel		46 PSF
4-in. concrete brick, lightweight		33 PSF
6-in. concrete block, stone or gravel		50 PSF
6-in. concrete block, lightweight		31 PSF
8-in. concrete block, stone or gravel		55 PSF
8-in. concrete block, lightweight		35 PSF
12-in. concrete block, stone or gravel		85 PSF
12-in. concrete block, lightweight		55 PSF
CONCRETE		
Plain	Cinder	108 PCF
	Expanded slag aggregate	100 PCF
	Expanded clay	90 PCF
	Slag	132 PCF
	Stone and cast stone	144 PCF
Reinforced	Cinder	111 PCF
	Slag	138 PCF
	Stone	150 PCF

(*Continued*)

Table 1.1 (*Continued*)

FINISH MATERIALS	
Fiberboard, ½-in.	0.75 PSF
Gypsum board, ½-in.	2 PSF
Marble and setting bed	25–30 PSF
Plaster, ½-in.	4.5 PSF
Plaster on wood lath	8 PSF
Plaster suspended on lath	10 PSF
Plywood, ½-in.	1.5 PSF
Tile, glazed wall ⅜-in.	3 PSF
Tile, ceramic mosaic, ¼-in.	2.5 PSF
Vinyl tile, ⅛-in.	1.33 PSF
Hardwood flooring, 25/32-in.	4 PSF
Wood block flooring, 3-in. on mastic	15 PSF
GLASS	
Polished float, ¼-in.	3.28 PSF
Polished float, ½-in.	6.56 PSF
Insulated unit ⅝-in. overall thickness	3.25 PSF
Glass block	18 PSF
INSULATION	
Blanket per 1-in. thickness	0.1–0.4 PSF
Corkboard per 1-in. thickness	0.58 PSF
Foamed board insulation—1-in. thickness	2.6 oz per SF
Board insulation	0.75 PSF
METALS	
Aluminum, cast	165 PCF
Brass, cast, rolled	534 PCF
Bronze, statuary	509 PCF
Copper, cast or rolled	556 PCF
Gold, cast, solid	1205 PCF
Iron, cast gray, pig	450 PCF
Iron, wrought	480 PCF
Lead	710 PCF
Nickel	565 PCF
Silver, cast, solid	656 PCF
Stainless steel, rolled	492–510 PCF

(*Continued*)

Table 1.1 (*Continued*)

Steel, rolled, cold drawn	490 PCF
Zinc, rolled, cast or sheet	449 PCF
MORTAR AND PLASTER	
Mortar, masonry	116 PCF
Plaster, gypsum, sand	104–120 PCF
PARTITIONS	
2 x 4 wood stud, gypsum board, two sides	8 PSF
4-in. metal stud, gypsum board, two sides	6 PSF
4-in. concrete block, lightweight, gypsum board	26 PSF
6-in. concrete block, lightweight, gypsum board	35 PSF
2-in. solid plaster	20 PSF
4-in. solid plaster	32 PSF
ROOFING MATERIALS	
Built up	6.5 PSF
Concrete roof tile	9.5 PSF
Copper	1.5–2.5 PSF
Corrugated iron	2 PSF
Deck, steel without roofing or insulation	2.2–3.6 PSF
Fiberglass panels (2½-in. corrugated)	5–8 oz per SF
Galvanized iron	1.2–1.7 PSF
Lead, ⅛-in.	6.8 PSF
Plastic sandwich panel, 2½-in. thick	2.6 PSF
Shingles, asphalt	1.7–2.8 PSF
Shingles, wood	2–3 PSF
Slate, 3/16-in. to ¼-in.	7–9.5 PSF
Slate, ⅜-in. to ½-in.	14–18 PSF
Stainless steel	2.5 PSF
Tile, cement flat	13 PSF
Tile, cement ribbed	16 PSF
Tile, clay shingle type	8–16 PSF
Tile, clay flat with setting bed	15–20 PSF
Wood sheathing per inch	3 PSF
SOIL, SAND, AND GRAVEL	
Ashes or cinder	40–50 PCF
Clay, damp and plastic	110 PCF
Clay, dry	63 PCF

(*Continued*)

Table 1.1 (*Continued*)

SOIL, SAND, AND GRAVEL	
Clay and gravel, dry	100 PCF
Earth, dry and loose	76 PCF
Earth, dry and packed	95 PCF
Earth, moist and loose	78 PCF
Earth, moist and packed	96 PCF
Earth, mud, packed	115 PCF
Sand or gravel, dry and loose	90–105 PCF
Sand or gravel, dry and packed	100–120 PCF
Sand or gravel, dry and wet	118–120 PCF
Silt, moist, loose	78 PCF
Silt, moist, packed	98 PCF
STONE (ASHLAR)	
Granite, limestone, crystalline	165 PCF
Limestone, oolitic	136 PCF
Marble	173 PCF
Sandstone, bluestone	144 PCF
Slate	172 PCF
STONE VENEER	
2-in. granite, ½-in. parging	30 PSF
4-in. granite, ½-in. parging	59 PSF
6-in. limestone facing, ½-in. parging	55 PSF
4-in. sandstone or bluestone, ½-in. parging	49 PSF
1-in. marble	13 PSF
1-in. slate	14 PSF
SUSPENDED CEILINGS	
Mineral fiber tile ¾-in., 12″ x 12″	1.2–1.57 PSF
Mineral fiberboard ⅝-in., 24″ x 24″	1.4 PSF
Acoustic plaster on gypsum lath base	10–11 PSF
WOOD	
Ash, commercial white	40.5 PCF
Birch, red oak, sweet and yellow	44 PCF
Cedar, northern white	22.2 PCF
Cedar, western red	24.2 PCF

(*Continued*)

Table 1.1 (*Continued*)

Cypress, southern	33.5 PCF
Douglas fir (coast region)	32.7 PCF
Fir, commercial white, Idaho white pine	27 PCF
Hemlock	28–29 PCF
Maple, hard (blacks and sugar)	44.6 PCF
Oak, white and red	47.3 PCF
Pine, northern white sugar	25 PCF
Pine, southern yellow	37.3 PCF
Pine, ponderosa, spruce: eastern and sitka	28.6 PCF
Poplar, yellow	29.4 PCF
Redwood	26 PCF
Walnut, black	38 PCF

Thermal Conductivity

Description

Table 1.2 provides conductivity values for some common building materials. Because changes often are required in the field, and variation in conductivity may play into decision making, it is important to have comparative values available. The values indicated are for dry materials in common use and are intended only as for use in preliminary calculations. Once the actual product is selected, additional evaluation and verification may be required.

Unless shown otherwise, descriptions of materials are for 75°C mean temperature.

Table 1.2 Thermal Conductivity Values of Common Building Materials

Material and Description	Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
BUILDING BOARDS, PANELS, FLOORING, ETC.			
Gypsum or veneer plaster base	50	1.11	—
Plywood	34	0.81	—
Sheathing, fiberboard	18	0.38	—
	22	0.41	—
	25	0.44	—
Wood fiberboard, laminate, or homogeneous	30	0.50	—
Hardboard	50	0.73	—
Particleboard	40	0.76	—
Wood subfloor	—	0.80	—
BUILDING PAPER			
Vapor—permeable 15-lb felt	—	—	16.70
Vapor—seal, two layers of mopped 15-lb felt	—	—	8.35

(*Continued*)

Table 1.2 (*Continued*)

Material and Description	Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
FINISH FLOORING MATERIALS			
Carpet and fibrous pad	—	—	0.48
Carpet and rubber pad	—	—	0.81
Hardwood	45	1.10	—
Tile—asphalt, linoleum, vinyl, rubber	—	—	20.00
INSULATING MATERIALS			
Blanket and batt[a]			
Mineral wool, fibrous form processed from rock, slag, or glass:			
Approximately 3–3½ in.	0.3–2.0	—	0.09
Approximately 5½–6½ in.	0.3–2.0	—	0.05
Approximately 6–7 in.	0.3–2.0	—	0.05
Approximately 8½—9 in.	0.3–2.0	—	0.03
Approximately 12 in.	0.3–2.0	—	0.03
Boards			
Cellular glass	8.5	0.35	—
Glass fiber	4.9	0.25	—
Expanded rubber (rigid)	4.5	0.22	—
Expanded polyurethane (R-11 blown)	1.5	0.16	—
Expanded polyurethane (extruded)			
Cut cell surface	1.8	0.25	—
Smooth skin surface	1.8–3.5	0.20	—
Expanded polyurethane (molded beads)	1.0	0.20	—
Mineral fiber with resin binder	15	0.29	—
Mineral fiberboard (wet felted)			
Core or roof insulation	16–17	0.34	—
Acoustic tile	18	0.35	—
Acoustic tile	21	0.37	—
Mineral fiberboard (wet molded)			
Acoustic tile[b]	23	0.42	—

(*Continued*)

Table 1.2 (*Continued*)

Material and Description	Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
Wood or cane fiberboard			
Acoustic tile[b] ½ in.	—	—	0.84
Acoustic tile[b] ¾ in.	—	—	0.56
Interior finish (plank, tile)	15	0.35	—
Cement fiber slabs (shredded with Portland cement boards)	25.0–27.0	0.50	—
Loose fill			
Mineral fiber (glass, slag, rock) 5 in.	0.6–2.0	—	0.09
6½–8¾ in.	0.6–2.0	—	0.05
10¼–13¾ in.	0.6–2.0	—	0.03
Vermiculite (exfoliated)	4.0–6.0	0.44	—
	7.0–8.2	0.47	—
Perlite (expanded)	2.0–4.1	0.29	—
	4.1–7.4	0.33	—
	7.4–11.0	0.38	—
Wood fiber, softwoods	2.0–35.0	0.30	—
MASONRY—CONCRETE			
Cement mortar	116	5.0	—
Gypsum fiber concrete: 87.5 percent gypsum, 12.5 percent wood chips	51	1.67	—
Lightweight aggregates including	120	5.26	—
Expanded shale, clay, or slate	100	3.57	—
Expanded slags, cinder, pumice	80	2.50	—
Perlite, vermiculite	60	1.69	—
Cellular concrete	40	1.16	—
	30	0.90	—
	20	0.70	—
Sand and gravel or stone aggregate (oven dried)	140	9.1	—

(*Continued*)

Table 1.2 (*Continued*)

Material and Description		Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
Sand and gravel or stone aggregate (not dried)		140	12.5	—
Stucco		116	5.0	—
MASONRY UNITS				
Brick, common		120	5.0	—
Brick, face		130	9.1	—
Concrete blocks, 3 oval core:				
Sand and gravel aggregate	4 in.	—	—	1.41
	8 in.	—	—	0.90
	12 in.	—	—	0.78
Cinder aggregate	3 in.	—	—	1.16
	4 in.	—	—	0.90
	8 in.	—	—	0.58
	12 in.	—	—	0.53
Lightweight aggregate (expanded shale, clay, slate, or slag; pumice)	3 in.	—	—	0.78
	4 in.	—	—	0.67
	8 in.	—	—	0.50
	12 in.	—	—	0.44
Concrete blocks, rectangular core: sand and gravel aggregate 2 core, 8 in., 36 lb		—	—	0.96
Lightweight aggregate (expanded shale, clay, slate, or slag; pumice:[c]				
3 core, 6 in. 19 lb		—	—	0.60
2 core, 8 in. 24 lb		—	—	0.46
3 core, 12 in. 38 lb		—	—	0.40
Granite, marble		150–175	20.0	—
Stone, lime, or sand		—	12.5	—
METALS				
Aluminum		171	1428	—
Brass, red		524–542	1000	—

(*Continued*)

Table 1.2 (*Continued*)

Material and Description	Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
Brass, yellow	524–542	833	—
Copper, cast rolled	550–555	2500	—
Iron, gray cast	438–445	333	—
Iron, pure	474–493	434	—
Lead	704	243	—
Steel, cold drawn	490	312	—
Steel, stainless, type 304	—	181	—
Zinc, cast	—	770	—
PLASTERING MATERIALS			
Cement plaster, sand aggregate	116	5.0	—
Sand aggregate ½ in.	—	—	10.0
Sand aggregate ¾ in.	—	—	6.67
Gypsum plaster:			
Lightweight aggregate ½ in.	45	—	3.12
Lightweight aggregate ⅝ in.	45	—	2.56
Lightweight aggregate, on metal lath ¾ in.	—	—	2.12
Perlite aggregate	45	1.49	—
Sand aggregate	105	5.55	—
Sand aggregate ½ in.	105	—	11.1
Sand aggregate ⅝ in.	105	—	9.1
Sand aggregate, on metal lath ¾ in.	—	—	7.69
Vermiculite aggregate	45	1.69	—
ROOFING			
1-ply membrane 0.048 in.	83	—	2.0
Asphalt roll roofing	70	—	6.67
Asphalt shingles	70	—	2.27
Built-up roofing ¾ in.	70	—	3.03
Slate ½ in.	—	—	20.0
SIDING MATERIALS (ON FLAT SURFACE)			
Shingles			
Wood, 16 in., 7½ in. exposure	—	—	1.15

(*Continued*)

Table 1.2 (*Continued*)

Material and Description	Density (pcf)	Conductivity/ in. Thickness (k)	Conductance for Thickness Listed (c)
Wood, double, 16 in. 12 in. exposure	—	—	0.84
Wood, plus insulation backer board, 5/16 in.	—	—	0.71
Siding:			
Aluminum (hollow backed over sheathing)	—	—	1.64
Vinyl (hollow backed over sheathing) 0.04 in.	—	—	1.00
Cedar shakes 1/2 in.	—	—	1.06
1/3 in.	—	—	0.59
Wood, drop. 1 by 8 in.	—	—	1.26
Wood, bevel, 1/2 by 8 in., lapped	—	—	1.23
Wood, bevel, 3/4 by 10 in., lapped	—	—	0.95
Architectural glass	—	—	10.0
WOOD			
Maple, oak, and similar hardwoods	45	1.09	—
Fir, pine, and similar softwoods	32	0.8	—
Fir, pine, and similar softwoods			
25/32 in.	32	—	1.02
1 1/2 in.	32	—	0.53
2 1/2 in.	32	—	0.32
3 1/2 in.	32	—	0.23
Door, 1 3/4 in. thick solid wood core			0.32
1 3/8 in. hollow core			0.45
STEEL DOORS (nominal thickness 1-3/4 in.)			
Mineral fiber core	—	—	0.59
Solid urethane foam core (with thermal break)	—	—	0.18
Solid polystyrene core (with thermal break)	—	—	0.47

(*Continued*)

Notes:
[a]Includes paper backing and facing if any. In cases where insulation forms a boundary (highly reflective or otherwise) of an air space, refer to appropriate table for the insulating value of the air space. Some manufacturers of blanket insulation mark their products with an R-value, but they can ensure only the quality of the material as shipped.
[b]Average values only are given because variations depend on density of the board and on the type, size, and depth of perforations.
[c]Weight of masonry units measuring approximately 7-5/8-in. high by 15-5/8-in. long is given to describe blocks tested. Values are for 1-sq. ft. area.

Resources

- American Institute of Architects, *Architectural Graphics Standards*, 11th ed. Hoboken, NJ: John Wiley and Sons, 2007.
- American Institute of Architects, *Graphic Standards for Residential Construction*, 2nd ed. Hoboken, NJ: John Wiley and Sons, 2010.