the value of U for a 1-in. yellow pine floor (actual thickness, 25/32 in.) placed directly on 6-in. concrete on the ground, is determined as follows:

$$U = \frac{1}{\frac{1}{1.65} + \frac{0.781}{0.80} + \frac{6.0}{12.0}} = 0.48 \text{ Btu per hour per square foot per degree difference}$$

in temperature between the ground and the air immediately above the floor.

Rigid insulation refers to so-called insulating board which may be used structurally, such as for sheathing. Flexible insulation refers to the blankets, quilts or semi-rigid types of insulation.

Actual thicknesses of lumber are used in the computations rather than nominal thicknesses. The computations for wood shingle roofs applied over wood stripping are based on 1 by 4 in. wood strips, spaced 2 in. apart. Since no reliable figures are available concerning the conductivity of Spanish and French clay roofing tile, of which there are many varieties, the figures for such types of roofs were taken the same as for slate roofs, as it is probable that the values of U for these two types of roofs will compare favorably.

The thicknesses upon which the coefficients in Tables 3 to 13 inclusive, are based are as follows:

Brick veneer	4 in.
Plaster and metal lath	¾ in.
Plaster (on wood lath, plasterboard, rigid insulation, board form, or corkboard)	½ in.
Slate (roofing)	½ in.
Stucco on wire mesh reinforcing	1 in.
Tar and gravel or slag-surfaced built-up roofing	⅜ in.
1-in. lumber (S-2-S)	25/32 in.
1½-in. lumber (S-2-S)	1⅜ in.
2-in. lumber (S-2-S)	1⅝ in.
2½-in. lumber (S-2-S)	2⅛ in.
3-in. lumber (S-2-S)	2⅝ in.
4-in. lumber (S-2-S)	3⅝ in.
Finish flooring (maple or oak)	13/16 in.

Solid brick walls are based on 4 in. hard brick (high density) and the remainder common brick (low density). Stucco is assumed to be 1 in. thick on masonry walls. Where metal lath and plaster are specified, the metal lath is neglected.

The coefficients of transmission of the pitched roofs in Table 12 apply where the roof is over a heated attic or top floor so the heat passes directly through the roof structure including whatever finish is applied to the underside of the roof rafters.

It is the practice of many engineers in calculating heat losses to use a minimum coefficient of 0.10 to allow for possible defects in workmanship, poor construction and other factors which would increase the heat loss. The lower the theoretical wall or roof coefficient the greater will be the percentage of error due to construction defects or failure of the insulation to perform as rated.

Combined Coefficients of Transmission

If the attic is unheated, the roof structure and ceiling of the top floor must both be taken into consideration, and the combined coefficient of transmission determined. The formula for calculating the combined

TABLE 2. CONDUCTIVITIES (k) AND CONDUCTANCES (C) OF BUILDING MATERIALS AND INSULATORS[a]

The coefficients are expressed in Btu per hour per square foot per degree Fahrenheit per 1 in. thickness unless otherwise indicated.

Material	Description	Density (Lb per Cu Ft)	Mean Temp (Deg Fahr)	Conductivity (k) or Conductance (C)	Resistivity $\left(\frac{1}{k}\right)$ or Resistance $\left(\frac{1}{C}\right)$	Authority
MASONRY MATERIALS						
Brick	Low density	———	——	5.00*	0.20	—
	High density	———	——	9.20*	0.11	—
	Adobe	———	——	3.56*	0.28	—
Brickwork	Damp or wet	———	——	5.00*	0.20	(2)
Cement Mortar	Typical	———	——	12.00*	0.08	—
Concrete	Typical	———	——	12.00*	0.08	—
	Various ages and mixes[d]	———	——	11.35 *to* 16.36	.....	(5)
	Concrete plank	76	75	2.5	4.0	(3)
	Cellular	40.0	75	1.06	0.94	(3)
	Cellular	50.0	75	1.44	0.69	(3)
	Cellular	60.0	75	1.80	0.56	(3)
	Cellular	70.0	75	2.18	0.46	(3)
	Typical fiber gypsum, 87.5% gypsum and 12.5% wood chips	51.2	74	1.66*	0.60	(4)
	Special concrete made with an aggregate of hardened clay—1-2-3 mix	101.0	70	3.98	0.25	(3)
	Sand and gravel	142.0	75	12.6	0.08	(4)
	Limestone	132.0	75	10.8	0.09	(4)
	Cinder	97.0	75	4.9	0.22	(4)
	Burned clay aggregate	75.0	75	4.0	0.25	(4)
	Blast furnace slag aggregate	76.0	70	1.6	0.63	(3)
	Expanded vermiculite aggregate	20	90	0.68	1.47	(3)
	Expanded vermiculite aggregate	26.7	90	0.76	1.32	(3)
	Expanded vermiculite aggregate	35	90	0.86	1.16	(3)
	Expanded vermiculite aggregate	50	90	1.10	0.91	(3)
Stone	Typical	———	——	12.50*	0.08	—
Stucco	Typical	———	——	12.00*	0.08	—
Tile	Typical hollow clay (4 in.)	———	——	1.00†*	1.00	—
	Typical hollow clay (6 in.)*	———	——	0.64†*	1.57	—
	Typical hollow clay (8 in.)*	———	——	0.60†*	1.67	—
	Typical hollow clay (10 in.)*	———	——	0.58†*	1.72	—
	Typical hollow clay (12 in.)*	———	——	0.40†*	2.50	—
	Typical hollow clay (16 in.)*	———	——	0.31†*	3.23	—
	Hollow clay (2 in.) ½-in. plaster both sides	120.0	110	1.00†	1.00	(2)
	Hollow clay (4 in.) ½-in. plaster both sides	127.0	100	0.60†	1.67	(2)
	Hollow clay (6 in.) ½-in. plaster both sides	124.3	105	0.47†	2.13	(2)
	Hollow gypsum (4 in.)	———	——	0.46†*	2.18	—
	Solid gypsum	51.8	70	1.66	0.60	(4)
	Solid gypsum	75.6	76	2.96	0.34	(4)
Tile or Terrazzo	Typical flooring	———	——	12.00*	0.08	—

AUTHORITIES:

[1]U. S. Bureau of Standards, tests based on samples submitted by manufacturers.
[2]A. C. Willard, L. C. Lichty, and L. A. Harding, tests conducted at the University of Illinois.
[3]J. C. Peebles, tests conducted at Armour Institute of Technology, based on samples submitted by manufacturers.
[4]F. B. Rowley, tests conducted at the University of Minnesota.
[5]A.S.H.V.E. Research Laboratory.
[6]E. A. Allcut, tests conducted at the University of Toronto.
[7]Lees and Charlton.

*Recommended conductivities and conductances for computing heat transmission coefficients.
†For thickness stated or used on construction, not per 1 in. thickness.
*For additional conductivity data see *A.S.R.E. Data Book*.
[b]If outside surface of block is painted with an impervious coat of paint, add 0.07 to resistance for sand and gravel blocks. Add 0.18 to resistance for cinder blocks. Add 0.17 to resistance for burned clay aggregate blocks.
*Recommended value. See Heating, Ventilating and Air Conditioning, by Harding and Willard, revised edition, 1932.
[d]See A.S.H.V.E. Research Report No. 915—Conductivity of Concrete, by F. C. Houghten and Carl Gutberlet (A.S.H.V.E. Transactions, Vol. 38, 1932, p. 47).
*The 6-in., 8-in., and 10-in. hollow tile figures are based on two cells in the direction of heat flow. The 12-in. hollow tile is based on three cells in the direction of heat flow. The 16-in. hollow tile consists of one 10-in. and one 6-in. tile, each having two cells in the direction of heat flow.
/Not compressed.
*Roofing, 0.15-in. thick (1.34 lb per sq ft), covered with gravel (0.83 lb per sq ft), combined thickness assumed 0.25.