

U_{ce} = coefficient of transmission of ceiling.

U_r = coefficient of transmission of roof.

n = ratio of roof area to ceiling area.

It should be noted that the overall coefficient U should be multiplied by the ceiling area to determine heat loss, and not by the roof area. Values of U_r and U_{ce} should be calculated using a value of 2.2 (the reciprocal of one-half the air space resistance) rather than 1.65 for the conductances of surfaces facing the attic, since the attic is equivalent to an air space.

If the attic contains windows, dormers and vertical wall spaces, and if their area is small compared to that of the roof, they may be considered part of the roof area. For accuracy, the sum of the coefficients of each individual section, multiplied by its percentage of the total area, should be used as U_r . Where attic wall areas are large, it is preferable to estimate the attic temperature as illustrated in Chapter 12, and calculate the heat loss through the ceiling by multiplying the value of U_{ce} for the ceiling by the difference in temperature above and below the ceiling.

Basement Floor, Basement Wall and Concrete Slab Floor Coefficients

The heat transfer through basement walls and floors to the ground is dependent on the temperature difference between the air within and that of the ground, on the material constituting the wall or floor, and on the conductivity of the surrounding earth. The conductivity of the earth will vary with local conditions, and is usually unknown. Tests¹² at the A.S.H.V.E. Research Laboratory indicate a heat flow of approximately 2.0 Btu per (hr) (sq ft) through an uninsulated concrete basement floor, with a temperature difference of 20 F between ground temperature and the air temperature 6 in. above the floor. Based on this result a coefficient of 0.10 Btu per (hr) (sq ft) (Fahrenheit degree difference) is recommended for calculation where it is desirable to allow for the small basement floor heat loss, e.g., for heated basements.

For basement walls the same coefficient may be used, but due to closer proximity to the surface of the ground, the temperature difference for winter design conditions will be greater than for the floor. The test results indicate a unit area heat loss, at mid-height of the basement wall approximately twice that of the same floor area.

For concrete slab floors laid in contact with the ground at grade level, recent tests¹³ indicate that for small floor areas (equal to that of a house 25 feet square) the heat loss may be calculated as proportional to the length of exposed edge rather than total area. This amounts to 0.81 Btu per (hr) (lineal foot of exposed edge) (Fahrenheit degree difference between the inside air temperature and the average outside air temperature). It should be noted that this may be appreciably reduced by insulating under the ground slab, and also along the edges between the floor and the abutting walls. See also sections on Basement Temperatures and Heat Loss, and on Floor Heat Loss in Basementless Houses, in Chapter 12. In most calculations if the perimeter loss is calculated accurately, no other floor loss need be considered.

Glass Coefficients

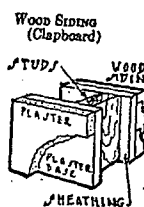
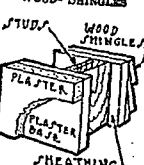
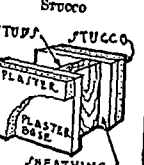
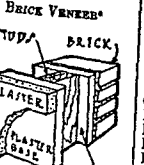
The U values for glass sheets and hollow glass block, given in Sections A, B and C of Table 20, have been computed by methods and data given in an A.S.H.V.E. Research Paper.¹⁴ It is assumed that the surface conductance for convection loss to the air is 4.0 Btu per (hr) (sq ft) (F deg). It

Heat Transmission Coefficients of Building Materials

TABLE 7. COEFFICIENTS OF TRANSMISSION (U) OF FRAME WALLS

These coefficients are expressed in Btu per (hour) (square foot) (Fahrenheit degree difference in temperature between the air on the two sides), and are based on an outside wind velocity of 15 mph.

NO INSULATION BETWEEN STUDS* (SEE TABLE 6)

EXTERIOR FINISH	INTERIOR FINISH	TYPE OF SHEATHING				WALL NUMBER
		GYP-SUM ($\frac{1}{2}$ IN. THICK)	PLY- WOOD ($\frac{1}{4}$ IN. THICK)	WOOD/ ($\frac{1}{2}$ IN. THICK) BLDG. PAPER	INSUL- ATING BOARD ($\frac{1}{2}$ IN. THICK)	
A	B	C	D			
	Metal Lath and Plaster ^a	0.33	0.32	0.26	0.20	1
	Gypsum Board ($\frac{3}{8}$ in.) Decorated	0.22	0.22	0.25	0.20	2
	Wood Lath and Plaster	0.31	0.31	0.25	0.19	3
	Gypsum Lath ($\frac{3}{8}$ in.) Plastered ^b	0.31	0.30	0.25	0.19	4
	Plywood ($\frac{3}{8}$ in.) Plain or Decorated	0.20	0.30	0.24	0.19	5
	Insulating Board ($\frac{1}{2}$ in.) Plain or Decorated	0.23	0.23	0.19	0.16	6
	Insulating Board Lath ($\frac{1}{2}$ in.) Plastered ^c	0.23	0.22	0.19	0.15	7
	Insulating Board Lath (1 in.) Plastered ^c	0.17	0.17	0.15	0.12	8
	Metal Lath and Plaster ^a	0.25	0.25	0.26	0.17	9
	Gypsum Board ($\frac{3}{8}$ in.) Decorated	0.25	0.25	0.26	0.17	10
	Wood Lath and Plaster	0.34	0.24	0.25	0.16	11
	Gypsum Lath ($\frac{3}{8}$ in.) Plastered ^b	0.24	0.24	0.25	0.16	12
	Plywood ($\frac{3}{8}$ in.) Plain or Decorated	0.24	0.24	0.24	0.16	13
	Insulating Board ($\frac{1}{2}$ in.) Plain or Decorated	0.19	0.19	0.19	0.14	14
	Insulating Board Lath ($\frac{1}{2}$ in.) Plastered ^c	0.19	0.18	0.19	0.13	15
	Insulating Board Lath (1 in.) Plastered ^c	0.14	0.14	0.15	0.11	16
	Metal Lath and Plaster ^a	0.43	0.42	0.32	0.23	17
	Gypsum Board ($\frac{3}{8}$ in.) Decorated	0.42	0.41	0.31	0.22	18
	Wood Lath and Plaster	0.40	0.39	0.30	0.22	19
	Gypsum Lath ($\frac{3}{8}$ in.) Plastered ^b	0.39	0.39	0.30	0.22	20
	Plywood ($\frac{3}{8}$ in.) Plain or Decorated	0.39	0.38	0.29	0.22	21
	Insulating Board ($\frac{1}{2}$ in.) Plain or Decorated	0.27	0.27	0.22	0.16	22
	Insulating Board Lath ($\frac{1}{2}$ in.) Plastered ^c	0.26	0.26	0.22	0.17	23
	Insulating Board Lath (1 in.) Plastered ^c	0.19	0.19	0.16	0.14	24
	Metal Lath and Plaster ^a	0.37	0.36	0.28	0.21	25
	Gypsum Board ($\frac{3}{8}$ in.) Decorated	0.36	0.36	0.28	0.21	26
	Wood Lath and Plaster	0.35	0.34	0.27	0.20	27
	Gypsum Lath ($\frac{3}{8}$ in.) Plastered ^b	0.34	0.34	0.27	0.20	28
	Plywood ($\frac{3}{8}$ in.) Plain or Decorated	0.34	0.33	0.27	0.20	29
	Insulating Board ($\frac{1}{2}$ in.) Plain or Decorated	0.25	0.25	0.21	0.17	30
	Insulating Board Lath ($\frac{1}{2}$ in.) Plastered ^c	0.24	0.24	0.20	0.16	31
	Insulating Board Lath (1 in.) Plastered ^c	0.18	0.18	0.15	0.13	32

(See text p. 100)

(See text p. 183.)

^a Coefficients not weighted; effect of studding neglected.

^b Plaster assumed $\frac{3}{8}$ in. thick.

^c Plaster assumed $\frac{1}{2}$ in. thick.

^d Furring strips (1 in. nominal thickness) between wood shingles and all sheathings except wood.

^e Small air space and mortar between building paper and brick veneer neglected.

^f Nominal thickness, 1 in.