Thermal Ratings

Much of the earlier work of determining thermal performance of building elements was based upon "steady-state" coefficients such as conductance (C), resistance (R) and U-factors (U). However, buildings do not operate in a steady-state environment. To be more realistic, an evaluation of building thermal performance should include heat storage capacity of the envelope (thermal inertia) as well as resistance to heat flow.

On its own, masonry has low R values. Using core-fill insulation raises this value slightly but due to the requirement for reinforcement in our seismic zones, little benefit is gained. Insulation is best placed in a continuous layer inside, or outside the wall.

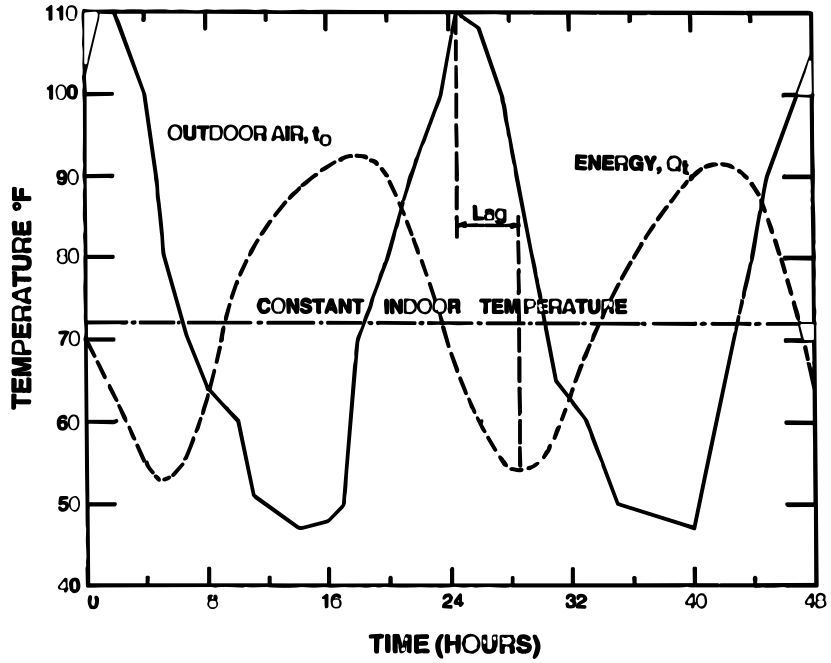
Thermal Properties (m^2 C° / W)

Block size:	100mm	150mm	200mm	250mm	300mm
RSI Factors CSA “A”	0.32	0.34	0.38	0.40	0.41

Walls constructed of 8” hollow CMU

	Details of Construction	Density 140 lbs/cu.ft.
1	No insulation	2.0
2	Cores filled with Vermiculite	3.6
3	Cores filled with Perlite	3.7
4	No insulation, ½” gypsum board on furring	3.4
5	No insulation, ½” foil back gypsum board on furring	5.0
6	Same as 4 with 1” Extruded Polystyrene	7.0
7	Same as 4 with 2” Expanded Polystyrene	10.0
8	Same as 4 with 2” Extruded Polystyrene	12.0
9	Same as 4 with 2” Polyisocyanurate	16.4
10	Same as 4 with R-11 fibrous batt 2x3 studs set out from wall	13.0
11	Same as 4 with R-13 fibrous batt 2x3 studs set out from wall	15.0
12	Same as 4 with R-19 fibrous batt 2x4 studs set out from wall	21.0

FIGURE 1: Definition of Thermal Lag



Masonry wall exhibit overall thermal performance superior to that of walls with metal framing systems with insulation of the same RSI value because their mass gives masonry walls the following advantages:

- Effective RSI value of a masonry wall is higher than a metal framed wall because of the thermal bridging that occurs at highly conductive metal framing members. (See Appendix B and Appendix C of the Model National Energy Code for Buildings 1997)
- Masonry walls keep buildings warmer in winter and cooler in summer; they act as passive solar collectors, even if they are not designed to do so. “Daylighting” is one such process where the sun’s heat allowed in through windows is absorbed by the masonry and slowly released later.
- Masonry walls act as a heat sink, absorbing and storing heat, and releasing it when low temperatures prevail. This reduces energy flow peaks and makes possible the use of smaller, cheaper heating and air-conditioning equipment.

For example, a building with masonry exterior walls will take up to 8 hours to transfer a temperature differential of 20 deg. Celsius (36 deg. F) from outside to inside – eight times as long as a non-masonry building of the same size, design and insulation would take.
This means that on a hot summer day, the outside temperature cannot work its way through the masonry wall before the cooler evening temperature arrives. The process works in reverse in winter. The time lag buys valuable time for the building's heating and cooling systems. With masonry exterior walls, buildings will stay cooler in summer and warmer in winter.

For more information on thermal mass effects, see the Guide to Sustainable Design with Concrete, available from the Cement Association of Canada website at www.cement.ca.