# Thermal Bridging

*Flir, a company that makes thermal imaging cameras, has some great shots of thermal bridging in action on their website. Here's just one example showing the "cold" 2×4's in a wall:*

*Thermal bridging can be responsible for 30% of heat loss from a home. Wood frame studs have a lower insulating value than the batten insulation between them, and if the studs are directly in contact with the inside and outside of the wall, they can act to conduct heat out on cold days, resulting in unwanted heat loss.*

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# Whole Wall System

*Infrared image of a wall portraying cold areas caused by the studs acting as a thermal bridge (dark lines).*

Richard T. Bynum writes in Insulation Handbook:

In a typical wood stud wall, the wooden studs are thermal bridges, and will create a cold area (compared with the insulated cavity) where the stud meets the interior sheetrock. This is illustrated in the infrared image above where the ñcold spotsò created by the studs show up as dark lines. These cold spots compromise the insulation and lower the effective average R-value of the whole wall. In addition to lowering the total R-value of a wall, the cold spot can lead to condensation problems. If any moisture did manage to get into the wall cavity, the cold wood stud near the sheetrock would be the first surface where water vapor would condense into liquid form.
ñCurrently, most wall R-value calculations are based on experience with conventional wood frame construction, and they do not factor in all the effects of additional structural members at windows, doors and exterior wall corners. Thus they tend to overestimate the actual field thermal performance of the whole wall systems.ò

Since the R-value of the insulation material alone does not accurately indicate the average R-value of the whole wall system, Bynum describes three methods for measuring R-values:

**Clear wall R-value:** This is the R-value of a wall with just studs and does not include the framing included in windows, doors and exterior corners.

**Center of Cavity R-value:** This is the R-value estimate of the area of the cavity space between studs that contains the most insulation.

**Whole wall R-value:** This is an R-value estimation that includes both the clear wall estimate of R-value and takes into account additional framing like windows, doors and exterior corners.
Bynum makes the statement that ñFor some conventional wall systems, the whole wall R-value is as much as 40 percent less then the clear wall R-value.ò
References. Bynum, Richard, 2001. Insulation Handbook, McGraw-Hill, New York, NY.

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# Radiant Heat from Masonry construction.

Masonry concrete is a high thermal mass radiant heat radiator.

Thermal mass can exacerbate the worst extremes of the climate and can be a huge energy and comfort liability. It will radiate heat to the inside all day and night in hot humid climates.

For example in a hot humid climate like south Florida, often times, the outside night time temperature can be warmer than the indoor conditioned A/C temperature settings.
Since heat travels to cold, radiant heat energy stored in masonry walls will radiate into the structure.
South Florida masonry construction homes are generally insulated, on the inside, with 1ò of R3.6 foam board placed between 1ò wood furring strips. The whole wall R-value will be R2.1. Radiant energy will only be slowed down slightly with R2.1

Ref.
ñThe whole wall R-value is as much as 40 percent less then the clear wall R-value.ò
References. Bynum, Richard, 2001. Insulation Handbook, McGraw-Hill, New York, NY.

Concrete has virtually no R value. R0.08. Ref. Oak Ridge National Laboratory.
*There is no substitute for a high R Value.*

To be effective, the thermal mass of masonry must be integrated with sound passive design techniques. This means having appropriate areas of glazing facing appropriate directions with appropriate levels of shading, ventilation, insulation and thermal mass.

How thermal mass works
Thermal mass acts as a thermal battery. During outdoor high temperatures it absorbs heat during the day and releases it to a homes interior cooler temperatures (interior cooled by the homes A/C). Heat goes to Cold. Law of physics.

Thermal mass is not a substitute for insulation. Thermal mass stores and re-releases heat; *Insulation stops heat flowing into or out of the building.*

A high thermal mass material. (Masonry or concrete) is not a good thermal insulator.
Use of high mass construction is generally not recommended in hot humid climates due to their limited diurnal range.

The more dense the material (i.e. the less trapped air), the higher its thermal mass.
For example, concrete has a high thermal mass, aerated concrete (AAC) blocks have a moderate thermal mass, and insulation has almost none.

## SIPLOCK is "*Simply Better*"

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