WHITE PAPERS

R-VALUE AND REVENUE

Make energy efficiency part of planning process and reduce life cycle costs.

ENERGY IS ONE OF THE MOST significant expenses for commercial facilities. Typically, heating and cooling costs represent about 32 percent of a building's operating budget. As this cost is multiplied over the average 10- to 20-year ownership period, energy expenses rank as a high-priority life cycle issue. This becomes even more significant to owners with multiple retail facilities.

Architects and contractors who want to maximize owner satisfaction will recognize that improving energy-efficiency can lower operating expense and improve tenant comfort. The economic and environmental benefits also make a property more competitive, resulting in better tenant retention and attraction. Lower expenses, in turn, produce higher net-operating income, resulting in increased property value. To reduce total cost of ownership, energy efficiency must be an integral part of the planning process.

Measuring R-Values Correctly

The most important factor in maximizing the energy efficiency of commercial buildings is in the design, materials and construction of exterior wall systems. But before deciding which materials and wall construction methods will enhance energy savings, specifiers must first be familiar with thermal calculation techniques.

"R-value" is a unit of measurement that describes the resistance of construction materials to the flow of heat. Unfortunately, some of the most common methods of calculating a building's energy efficiency using R-values are the least accurate. Here's why.

Heat takes the path of least resistance. Heat is transferred in three ways: by conduction, radiation, and convection. Heat flows from warm to cold and, like fluid movement, heat will find a way through almost any material. For example, if a plastic sheet—which is essentially impermeable—has a pinprick in it, water will flow through the pinprick as fast as the hole will allow. The permeability of that sheet, in essence, becomes the same as the permeability of the pinprick, rendering the permeability of the plastic unimportant.

In the same way, heat will find the path of least resistance and the R-value of the wall approaches that of the least insulating portion of the wall. Failure to recognize this can lead to inaccuracies in a building's R-value.

You are only as strong as your weakest link. The most common method of calculating R-values for wall systems is to add the R-values of all the materials that make up the panel. For example, with a wall panel that has a 3-inch layer of concrete, a 2-inch layer of foam, and another 3-inch layer of concrete, the total R-value would simply be the combined R-value of all the materials. This method assumes a steady-state heat flow, in which the difference in temperature across all material layers is steady at all times.

When R-values are calculated this way, the potential for thermal breaks is not taken into account. Thermal breaks are areas that violate the insulation area and greatly reduce energy efficiency. With wall panels, thermal breaks can range from the obvious, such as doors and windows, to those that are invisible to the eye, such as highly conductive insulation voids embedded in the wall. In the previous example of two concrete layers sandwiching a layer of foam, there would usually be metal ties and concrete to hold the different layers together. These metal ties and concrete are thermal breaks that allow heat to pass through the concrete layer, just like the pinprick in the plastic sheet, reducing energy efficiency.

Benefits of thermal mass. In real-life situations, inside and outside temperatures are not always constant. The force behind conductive heat flow between the exterior and interior of a wall can change significantly and even reverse during the day. For example, if a building's exterior wall is dark-colored and in the sun, it will be significantly hotter than the outside temperature. If the temperature on the inside of the building is cooler than on the outside, heat will conduct from the outside surface of the wall inward. But as the exterior temperature falls at night,

the driving force for heat flow reverses. Energy, as heat, is drawn from the inside to the outside of the building through conductive heat transfer.

With high mass materials, such as concrete, this heat transfer is delayed and even blocked by the high heat retention capacity of the wall mass. This "mass effect" has a quantifiable effect on the energy efficiency of a wall that cannot be determined by R-value alone. When choosing a building material, considering how "mass effect" can enhance energy efficiency is as important as determining a material's R-value.

Energy Efficiency: A Planning Process Issue

Decisions made during design and construction stages will affect cost and performance of buildings for decades to come—especially regarding energy consumption. The fluctuating supply and price of energy has led many building owners to look for smarter ways to use energy resources. Concerns over energy efficiency will continue to increase as new energy regulations are put in place, and energy-optimizing choices will soon no longer be an option; they will be a necessity. Owners must consider life cycle costs, especially when making initial cost and schedule decisions.

To help determine the best exterior wall system for your needs, ask the following questions:

How can I maximize energy efficiency? Ask about R-value. The higher the R-value, the more energy-efficient your building will be, lowering your heating and cooling costs.

Will temperatures be fluctuating significantly throughout the day? If so, does it make sense to use a high-capacity material to take advantage of "mass effect" and a higher effective R-value?

Will there be thermal breaks or highly conductive structural ribs that will violate the insulation layer, reducing thermal resistance? Are there structural wall systems available which do not have thermal breaks?

What kind of maintenance is needed? Paint, tuck-pointing, caulking, and damage repair can all add to the cost of a building. While some maintenance procedures are relatively inexpensive, such as caulking (approximately 35 cents per square foot of wall space), other procedures, such as tuck-pointing, can be surprisingly high.

How can I reduce wall "movement" and maintain a "tight" building? Wall systems that excessively flex and bow, have high air infiltration rates, or have high moisture permeability can compromise your building envelope's R-value.

How can I achieve maximum building flexibility using a particular option? Adding a window, pedestrian door or a new addition to a building is much easier if the wall system can handle varying load capacities, if the wall panels can be moved and re-used, and if extra openings require no special structural supports.

How can quality be assured? With precast, ask if the supplier is PCI (Precast Concrete Institute) certified. Ask about the reputation and experience of the people erecting the panels.

For more information, contact Fabcon at 1-800-727-4444.