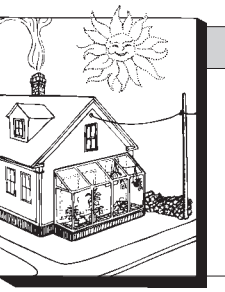

How Much Foundation Insulation Is Needed?

by Chuck Silver and Terry Brennan

Insulated foundations have become the norm in recent years in the Northeast, but there are many ways to achieve the desired strength and insulation value. It's important to decide what R-values you want before you select a system, since some methods lend themselves to achieving high R-values and some don't.

The criteria I use to determine appropriate R-values below grade include:

Building code requirements. Increasingly, building codes are addressing foundation heat loss. In New York State the code requires R-11 insulation. But there is a "flexible" component to the code that allows reduced R-values in one part of a house when another part exceeds code, and when the net effect on the building's energy performance will be the same.

Expected use of space. Is the basement fully developed into living space (bedrooms, family room, etc.) or is it only for storage? Might it be developed later?

Percentage of the wall above grade. On a sloped site, builders often make walk-out basements that have one wall fully above grade. These walls experience the same weather conditions as the above-grade walls. The adjacent walls may only be 50 percent below grade. On a level site, bringing the basement out of the ground another foot or two makes possible the use of larger windows, which can greatly improve the quality of the space and save some excavation.

R-values in the rest of the building. If you're building a superinsulated house and the basement is going to serve as living space, it makes sense to take the same approach here as in other parts of the building. If you build to the code minimum, however, there's no point in getting carried away with this one component.

Economic justification. I've discussed this matter in a previous column, so I'll just review it here. I put all the energy improvements (insulation values that exceed minimum code) into one package, called the Energy Upgrade Package. I choose what I consider to be a reasonable, attainable building envelope system, and I quote a price for the package. If the additional cost for this upgrade (say $5,000) is added to the mortgage, there is an increase in the monthly mortgage payment of about $50. In most cases, I can save that in fuel bills so there is little or no increase in annual costs. And there's the added benefit of being able to take a tax deduction on mortgage interest where no deduction would be granted had the same money been spent on fuel. I'll restrain myself from harping on the added benefits of importing less oil from troubled parts of the world, contributing less to the greenhouse effect, etc.

The Options

There are four main approaches to an insulated foundation, each with pros and cons. They are: exterior insulation alone, interior insulation alone, both exterior and interior insulation, and insulation internal to the structural wall. A host of factors other than heat loss and costs affect which choice is best.

It's important to note that not all systems will play to all audiences. Your client may be predisposed to a poured concrete wall while you were hoping to try insulated block. The local building code official can make your life miserable for trying something new. There is probably a traditional method for foundations in your area. Even if it has undergone some ill-conceived modifications to meet the code, it is probably still more acceptable to some than an unfamiliar product or system.

There is also some personal risk. Most of my clients are knowledgeable and some are interested in the specific construction details. I like to share information with them, and in some cases, get them involved in the decision-making process by offering them various options. The best opportunity for me to try something new comes when an educated customer wants to try it. I point out what I see as the potential gains and the potential problems, and we proceed. The risk is shared, and my risk is therefore reduced, since the customer is involved in the decision. I don't really do anything that isn't proven, but I am willing to try new things when they make sense.

Choosing R-values

It is a well-known fact that soil temperatures are more stable than air temperatures and walls below grade don't experience the same air-infiltration pressures. So why not have less R-value on the foundation than you would have on the framed walls? the answer depends on the criteria I outlined earlier.

In a case where the basement is to be used as living space, and the walls are out of the ground a bit, conditions aren't much different from above-grade walls. The above-grade section of the foundation experiences the same weather as the above-grade framed walls. And the below-grade section also faces cold conditions. In my area, for instance, the frost penetrates about 3 1/2 feet below grade in the winter. That only leaves maybe 1 1/2 feet of foundation below the frost level, and the temperature there does not drop suddenly to 50°F. Rather, the temperature drops gradually from 32°F at the frost line to 50°F at around an 8-foot depth. So in the Northeast, I believe this type of foundation should have the same R-value as walls above grade.

In cases where the walls are buried deeper, it makes theoretical sense to reduce R-value with depth. There are few practical ways to accomplish this, however. With exterior foam installed in layers, it is possible to reduce the number of layers incrementally with depth. A practical problem with this approach is that it leaves a horizontal lip where you reduce from one thickness to another. If this transition occurs above frost depth, the soil may lift the insulation from this lip, tearing it off the building as it moves up due to frost heave.

Most times, my framed walls exceed R-30. It wouldn't bother me a lot to have R-25 or even R-20 below grade, depending on the circumstances. If you decide on the appropriate R-value from the start, certain foundation systems or insulation options may be impractical, and others may suddenly become more appealing. In a later column we'll look at the pros and cons of the four methods outlined above, and explore specific products and systems developed that meet the demand for better insulated foundations. ■

Chuck Silver designs custom homes, and Terry Brennan consults on energy design. They currently run training seminars on energy-efficient construction for the New York State Energy Office.