Air Sealing Houses to Control Intruders

Houses are being built more airtight. The increased airtightness came about due to changes in construction methods and materials. Another motivation for change was the added benefit of energy savings from airtight construction. A side benefit, and a more important one, is that properly built, airtight construction is more durable construction. Airtight construction reduces the leakage of warm moist air from the interior, which can condense and lead to premature structural deterioration.

We also have to remember that the building envelope is part of a system. All parts are integrated, and work as a whole. Properly detailed, airtight construction also reduces exterior moisture penetration into the building envelope. If the building is airtight, it will also be watertight. In other words, the tighter the building, the less water will get through.

Another, lesser-known benefit of airtight construction is that if there are no holes, it will be more difficult for "intruders" to enter the house. The intruders can be insects, or more substantial animals like rodents. This is not just an issue of aesthetics or human fear. It can have serious health effects. Rodents are carriers of toxic viruses and illnesses, some very serious, such as the hanta virus that is spread by deer mice.

If most of the ventilation is provided by a heat recovery ventilation system, the number of air borne insects (mosquitoes, flies, and other bugs) are also reduced. If you have doubts, just ask whoever has ever cleaned an HRV in the fall. When the unit is opened, a large number of dead bugs will be found on the supply air filter.

The third party certification of R-2000 houses provides a measure of certainty that a house as-built will indeed be airtight, thus reducing the chances of letting in unwanted occupants.

Slab-on-Grade Insulation: How Much Is Required?

The heat loss through an un-insulated radiantly heated slab can be reduced by as much as 46% if insulated with 2" (R 8) of expanded polystyrene (EPS).

We know that heat flows from a warmer area to a colder one, whether up, down or sideways. But because the perception persists that soil is a good insulator, basements and floor slabs do not get insulated to levels they should. This is especially important in buildings where floor radiant heating is installed.

Installing a hydronically-heated slab-on-grade without insulation under it makes about the same sense as installing a single pane window in a new house. Yet resistance to using insulation below concrete slabs exists in part because there has not been much research on heat loss through floor slabs. The limited information available suggests that little insulation is needed in this location for energy savings.

Most recommendations for sub-slab insulation are based on unheated slabs. However, heat loss through radiantly heated floors is so much higher than through unheated slabs, that the normal rules and practice for insulating unheated slabs clearly do not apply to radiantly heated ones. However, there is no published research on heated floor slabs. In addition, many concrete slab-on-grade floors are placed over wet soils (which are highly conductive) or over high water tables (which are very high capacity heat sinks). Clearly, more insulation is required for heated slabs, but how much?

Dr. John Straube from Waterloo did a series of computer simulations to determine the energy savings that could be achieved using below slab insulation in heated slabs. The simulations modelled two common foundation/basement situations: a range of insulation values, and a range of soil properties. Since it takes about three to five years to stabilize soil temperatures under a slab, the study took the fifth heating season for the calculation period.

As can be expected, under-slab insulation can significantly reduce heat loss. In an un-insulated heated slab, almost half the purchased energy is lost to the soil. The size of the energy savings will depend on many variables such as climate, house design, floor finishes and soil properties. For example, a floor finish that is a good insulator (like

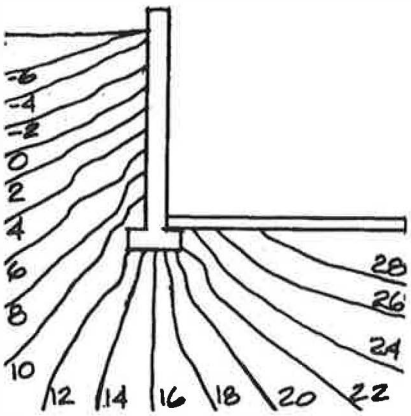
carpets) will require higher slab temperatures to provide enough heat into the house. The hotter the slab, the more heat lost to the soil.

Surprisingly, there is not a big difference in heat loss between a slab-on-grade and a basement floor 6 feet below grade. The heat loss for a slab on grade is only about 15% more for the full basement floor. The additional 6 feet of soil is not an effective insulator.

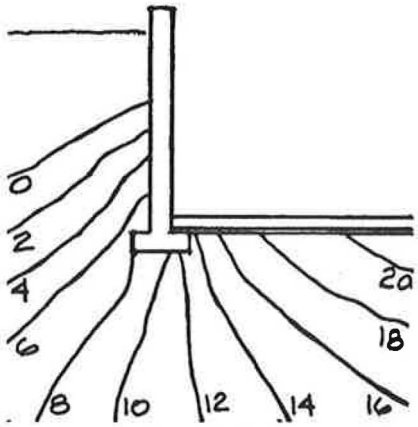
The heat loss through an un-insulated radiantly heated slab can be reduced by as much as 46% if insulated with 2" (R 8) of expanded polystyrene (EPS). Three inches (R 12) could be expected to reduce sub-slab heat loss by more then 50%.

Another important issue is the slab edge insulation. A piece of 4" high and ¾" thick EPS between the slab and the foundation wall is likely the most effective piece of insulation in the entire house. If possible, this insulation between the heated slab and the unheated wall should be at least 1" thick.

This study was commissioned by Beaver Plastics, an Edmonton-based manufacturer of EPS insulation products. They wanted to have some scientific evidence to be able to answer questions commonly raised. However, the information is based on 2" of generic EPS insulation.



Soil temperatures in February under an uninsulated floor slab



Soil temperatures in February under an insulated floor slab

Effectiveness of Beaver Plastics' INSULWORKS insulation system used below radiant floor slabs. *Prepared for: Beaver Plastics, Edmonton, Alberta, Canada by: Dr. John Straube and Chris Schumacher of John Straube Building Envelope Engineering, Waterloo, Ontario, Canada*

The full report can be found on the Internet at www.beaverplastics.com

Letter to the Editor

Re: Building Durability, Design Life and Maintenance (Solplan Review No. 92, May 2000)

I would like to make an observation. You cannot buy any shingles here with less than a 20-year life. Shingles with a 10-year life have not been available for some time. I would think the range should be more like 20 - 40 years.

Also, the standard warranty for membrane readings is 10 years with the odd exception to 20 years by special product. 10 to 12 years is probably a more likely range. Also, there can be some maintenance if there is moss growth, high winds, etc. I am not criticizing, just trying to help update and make the information as accurate as possible.

Doug Harrison,
Advanced Energy Group
Delta, BC

Thanks for the note. While you are correct about the materials being sold, I understand that, in practice, the life span of various products does vary. In some regions, especially those with hot intense summer sunshine, dark-coloured roof shingles seem to deteriorate prematurely while light-coloured ones last longer. In addition, contrary to perceptions of natural durability, cedar shingles can deteriorate in less than ten years.

The important point to keep in mind is that the actual life span will vary depending on many factors, including climatic stresses, installation practices, and design features. The life span may be longer or shorter than manufacturers' claims. Even though we rely on a product's rated durability, actual product performance may not always meet our (or manufacturers') expectations. Ed.