LEEP Case Study 1.3: Insulated Concrete Forms (ICF)

This case study is part of a series that explores how builders resolved issues through their participation in Natural Resources Canada's Local Energy Efficiency Partnerships (LEEP) process.

The Builder

Monkhouse Homes is an Energy Star builder in Sudbury, Ontario. Monkhouse Homes (www.monkhousehomes.com) builds custom bungalow and two storey homes.

Monkhouse Homes single detached home

The Challenge

To increase the amount of comfortable living space in new homes with warmer, more energy efficient basements.

The Technology Choice

Insulated Concrete Forms (ICFs) are modular forms that are typically made from expanded polystyrene and assembled on site. Once the concrete is poured, the foam remains in place, providing full height basement insulation and basement walls ready for finishing.

Insulated Concrete Form (ICF)

The Result

Monkhouse Homes uses Insulated Concrete Form (ICF) foundations as part of their approach to improving the comfort and energy performance of their basements.

The LEEP Process

LEEP is a builder driven technology assessment, selection and trial process developed and delivered by Natural Resources Canada's Innovation & Energy Technology Sector's LEEP team with technical support provided by CanmetENERGY's housing researchers. To learn more, email us at LEEP@nrcan-rncan.gc.ca.

See Pages 2 and 3 for Questions and Answers with Monkhouse Homes on their LEEP ICF case study.

See Page 4 for Questions and Answers with CanmetENERGY on high performance ICF systems.

This case study resulted from the expanded LEEP pilot that took place in four Ontario regions during 2011 and 2012.

Natural Resources Canada wishes to thank all funding partners, builder participants, industry associations and manufacturers who have helped develop LEEP for the benefit of the building industry.

In discussion with Phil Monkhouse of Monkhouse Homes.

Participation in the Local Energy Efficiency Partnerships (LEEP) program in the Sudbury area helped Monkhouse Homes standardize on insulated concrete form (ICF) foundations with under slab insulation. Their finished basements are now more energy-efficient and comfortable than traditional basements, providing home owners with more and better living space. Phil Monkhouse speaks about his LEEP experience below.

How did you learn about LEEP?

We learned about it through our local home builders' association. The executive director thought that LEEP would be a good fit for us and suggested we try it.

I know you're Energy-Star certified. Was your LEEP participation related to that?

We were doing Energy Star before our LEEP participation, but it's just a natural fit for sure. These new LEEP technologies help our Energy Star scores.

What was it about LEEP that appealed to you the most?

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And LEEP helped you do that?

Yes. LEEP provided a lot of support when it came to technologies like solar ready and triple-glazed windows. And LEEP got us back into ICFs.

ICFs – that's insulated concrete forms?

Right. We'd done houses with ICFs before LEEP, but we gave up on them. One thing about ICFs that was a struggle, and that pretty much eliminated them for us, is that you have brick ledges on ICF homes. People don't like the look of them. There are ways to hide them, but it really starts to add up pricewise. It seemed impractical, so we dropped ICF as an approach to building foundations.

How did LEEP get you back to ICFs then?

Well, during the LEEP process an ICF supplier rep and I talked about how to eliminate the brick ledge problem with ICFs. And in one of the test houses we built as part of the LEEP process we did an ICF foundation with under slab insulation. And it worked out really well. We sold the house, there are people living in it, and they are very happy with it.

What is it about ICFs that makes them so appealing?

What we were doing before was building block basements with a poured floor, which is pretty typical in Sudbury. Using ICF walls with insulation under the slab you get a much more comfortable living space. It's got a more even temperature and is a lot more comfortable than a traditional basement. And the basement is going to stay dryer.

What part does the under slab insulation play?

It's another technology that goes into almost all our houses now. It's an inch or so of foam that goes underneath the basement floor. You'd be amazed how much more comfortable it is when you're standing on the floor. It gets the chill off the slab, and it's been really well received. It doesn't cost a ton of money, and it's quick and easy for us to do.

So the big benefit with ICF and under slab insulation is increased comfort?

Yes. It's not done from the standpoint of saving huge amounts of money on your heating bill, it's mainly about comfort.

Are there other benefits to ICF?

Oh sure, the benefits go beyond comfort. ICF pretty much eliminates the potential for condensation behind the walls that can occur in normal split-frame basement construction. That's another big advantage, just getting rid of condensation. People are sensitive about condensation and mould, and ICF pretty much solves that.

Does ICF and a finished basement make it easier for you to sell a house?

I think it does. We get a lot of demand for bungalows, and a finished basement is pretty much expected of us. Every house we did last year had a finished basement. It is a selling point. And it's another thing that helps brand us as a green builder. And ICF plays a big part in that.

I guess when you include a finished basement in a bungalow you're just about doubling your usable square footage?

Yes, that's right. And at substantially lower cost than if you were adding above grade.

How does building an ICF foundation compare to building a traditional one?

Well, if anything, the ICF approach helps us with timelines. We run a framing crew that also does ICF. So we control when it goes up. So ICF speeds things up compared to a more traditional approach. And unlike the traditional approach the walls are ready for finishing right away.

How about the cost?

Block is the least expensive way for us to build foundations in Sudbury. For every extra dollar it costs to go to a poured foundation, it costs another 50 cents on top to go to an ICF approach. But taking into account that we don't have to strap the walls in the basement and a couple of other things, it might be less.

Anything further on costs?

It might be a little lower. But then, it's cheaper when I have my own forces do it. We're different in the sense that a lot of the things we do are "hands on," not subcontracted out, and I like being able to do the ICF with my own crew.

So you see the extra cost as worth it?

Yes, the benefits outweigh the added cost. You get a much more comfortable basement with more even temperatures and less condensation. And it's more energy efficient.

Any other benefits?

Well, as much as anything, I do ICF for my own protection. I've seen the condensation behind the poly on some traditional foundations, and I just don't like it. Getting rid of that is a big motivator for us, and a big reason why we switched. So the comfort, the increased living space with a finished basement, energy savings, and the healthier mould-free home environment are pretty much why we use ICF now.

To learn how LEEP can help, ask your Home Building Association to contact: **LEEP@NRCan-RNCan.gc.ca**

An Insight into High Performance Insulated Concrete Forms (ICFs) from Natural Resources Canada's CanmetENERGY Housing Research Team.

What are ICFs made of?

ICFs are typically made from expanded polystyrene (EPS) foam. Alternative options include use of extruded polystyrene (XPS), or recycled polystyrene or waste wood mixtures with concrete. Standard ICF blocks typically come with insulations levels in the vicinity of RSI 3.87 (R-22).

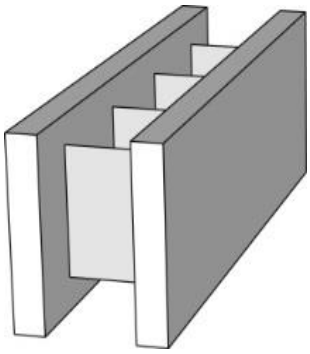

Figure 1: Illustration of standard ICF block

Are there higher performance options?

Some manufacturers provide additive systems for incorporating higher levels of insulation to their blocks. Insulation levels offered for these additive systems can raise performance to RSI 7.04 (R-40) and beyond. Typically thermal performance is increased by thickening the insulation panels on one or both sides of each block. Alternately, flat stock EPS can be added to the interior or exterior of the concrete form to increase insulation levels. Builders must consult with manufacturers for related system specifications and installation details.

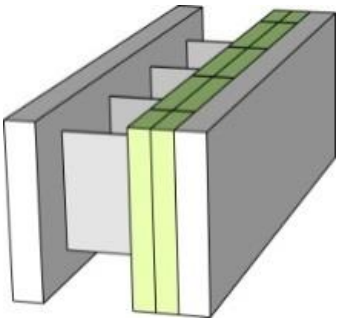

Figure 2: Illustration of Wide ICF Block plus rigid insulation inserts

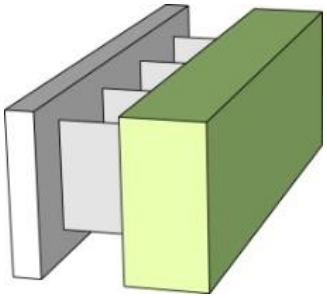

Figure 3: Illustration of preassembled High R-value ICF Block

What about the thermal characteristics of an ICF wall?

ICFs construction minimizes thermal bridging due to the layers of continuous inboard and outboard insulation. Research has shown that an ICF structure can have some effect shifting peak loads. This thermal lag has a negligible effect on the effective R-value (RSI) of ICF walls or on the annual energy consumption of home built using ICF. Builders can use energy simulation software such as HOT2000 or work with an energy evaluator to determine the impact of varying ICF insulation levels on home energy performance.