

## Insulating concrete forms

Today, home buyers expect to get more from their new home. They want beauty that's more than skin deep. A home that fits their lifestyle - of course but also a home with solid, high quality constructions, greater comfort and security.

Lower energy bills. Lower maintenance. A home that's healthier to live in, and easier on the environment.

It's becoming harder and harder to meet their new expectations with the same old building technology - wood framing. So more and more builders and home buyers are turning to something new. A modern adaptation of a centuries-old technology using the most proven building material on earth. Concrete.

Insulating Concrete Forms (ICFs) give you all the benefits that have made concrete the material of choice for home building worldwide: Solid, lasting construction that resists the ravages of fire, wind, and Father Time. But ICFs do plain concrete one better - or rather, two better - by giving you two built-in layers of foam insulation.



This gives an ICF home some sizable advantages over an ordinary stick-built home. Greater energy efficiency. More peace & quiet. More sheer day-to-day living comfort. All wrapped up in a solid, high-quality building package that gives an ICF home an utterly remarkable feel that really has to be experienced to be believed. As soon as you step inside, you can tell that an ICF home is not an ordinary house. It's not just beautiful, comfortable and quiet. You can feel that it's solid, built to last.

So just how expensive is it to get all these extraordinary benefits? The truth is you can get superior ICF technology for a lot less than you'd think. ICFs are so efficient to build with and easy to use, that the cost of building an ICF house is comparable to that of an ordinary 2x6 wood-framed house. But you get so much more home for your money.

# Energy Savings

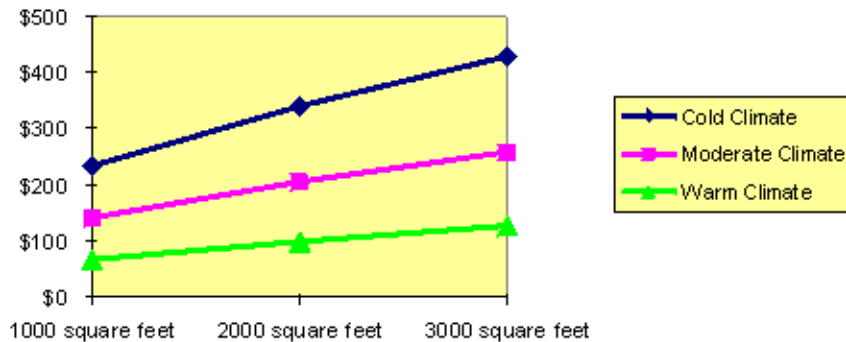
Building a concrete home with insulating concrete forms (ICFs) saves energy and money. The greater insulation, tighter construction, and temperature-smoothing mass of the walls conserve heating and cooling energy much better than conventional wood-frame walls. This reduces monthly fuel bills. It also allows use of smaller heating and cooling equipment, saving money in construction.

How much will I save?

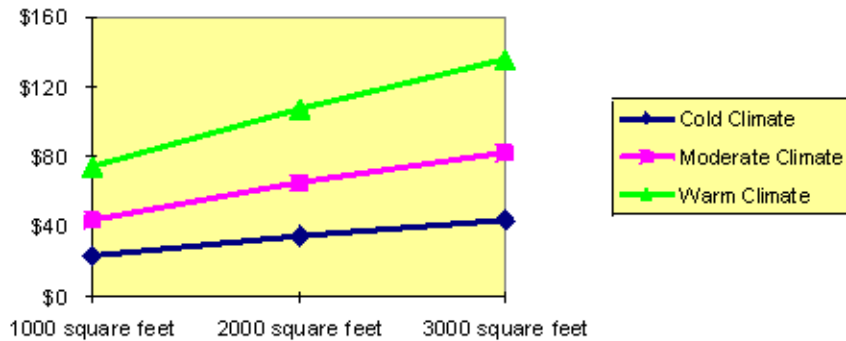
Houses built with ICF exterior walls require an estimated 44% less energy to heat and 32% less energy to cool than comparable frame houses. A typical 2000 square foot home in the center of the U.S. will save approximately \$200 in heating costs each year and \$65 in air conditioning each year.

The bigger the house the bigger the savings. In colder areas of the U.S. and Canada, heating savings will be more and cooling savings less. In hotter areas, heating savings will be less and cooling savings more.

Estimated Annual Heating Savings



Estimated Annual Cooling Savings



The smaller heating and cooling equipment needed for such an energy-efficient house can cut construction costs by an estimated \$500 to \$2000. The biggest equipment savings come with the houses that have the most energy savings. How do we know all this?

The energy savings estimates come from a study of single-family houses spread across the U.S. and Canada. Researchers gathered data on 58 houses in all. Half had exterior walls constructed with concrete using ICFs made of expanded polystyrene (EPS) or extruded polystyrene (XPS) foam. The other half were neighboring houses with walls constructed of wood frame. All houses were relatively new (less than 6 years old) and built with modern methods.

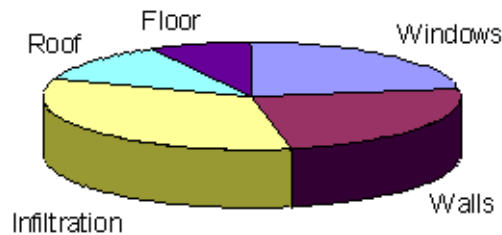
The researchers compared the energy bill of each concrete house to its frame counterpart, carefully correcting for important differences to get an "apples-to-apples" comparison.

Estimates of equipment savings are actual numbers reported by contractors that build ICF houses.

Where do the savings come from?

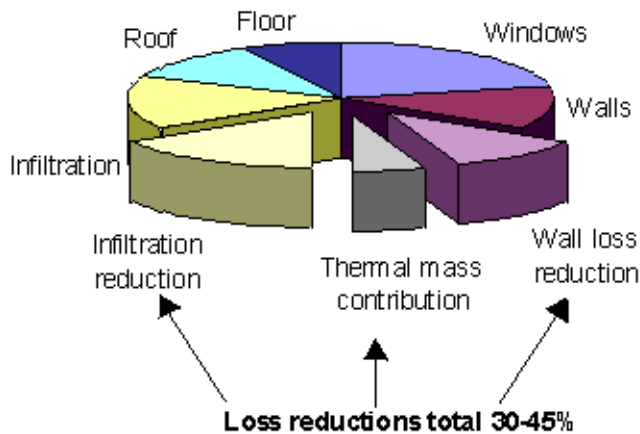
Insulating values for ICF walls using polystyrene foam are R-17 to R-26, compared to wood frame's R-9 to R-

15. So ICF walls are expected to cut the conduction losses through foundation and above-grade walls by about half. And ICF walls are tighter. In tests, ICF houses averaged about 1/2 as much infiltration (air leakage) as frame.



Sources of Energy loss

Energy Loss Reduction



ICF walls do more than cut down on the biggest types of energy loss. The concrete gives them the heat-absorbing property, "thermal mass". This is the ability to smooth out large swings in temperature. It keeps the walls of the house a little warmer when the outdoor temperature hits its coldest extreme, and keeps the house a little cooler when the outdoor temperature is hottest. The walls themselves "add back" heat or cooling to the house when it needs them most. This contributes about 6% of the needed energy to the house for free.

Reduced equipment costs result from the energy savings. Since the energy needed is less, the furnaces and compressors that heat and cool can be smaller. And the more the energy savings, the greater the possible reduction in equipment size—and the equipment cost.

What's the bottom line?

In planning a new house you can estimate that building the walls of concrete using ICFs will save you hundreds of dollars per year in energy costs. As shown in the graphs, the savings are greater the bigger the house. Heating savings are highest in cold climates, and cooling savings highest in warm climates.

You may also save hundreds or thousands of dollars in construction costs for heating and cooling equipment. Talk with an ICF homebuilder for estimates.

More Information?

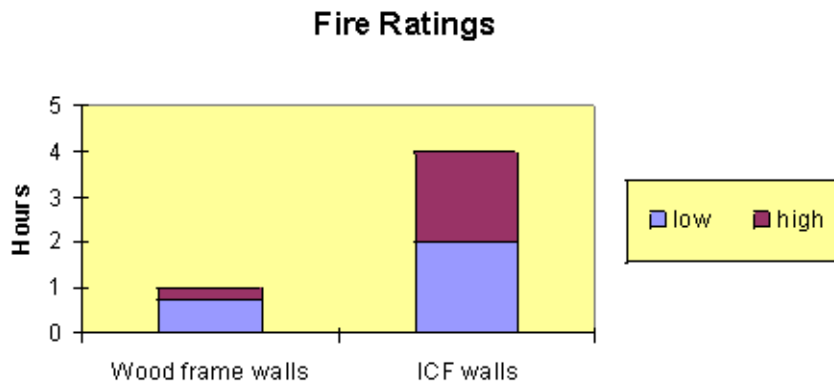
VanderWerf, "Energy Consumption Comparisons of Concrete Homes versus Wood Frame Homes". Portland Cement Association. 1997.

# Fire Resistance of Concrete Homes

Of all construction materials, concrete is one of the most resistant to heat and fire. Such fire resistance gives houses built with insulating concrete forms (ICFs) certain safety advantages. Those advantages give builders and buyers yet another reason to consider using ICFs for their next project.

## How well do ICF walls hold up in a fire?

Experience shows that concrete structures are more likely to remain standing through fire than are structures of other materials. Unlike wood, concrete does not burn. Unlike steel, it does not soften and bend. Concrete does not break down until it is exposed to thousands of degrees Fahrenheit—far more than is present in the typical house fire.



These Fire ratings have been confirmed in so-called “fire-wall” tests. In these tests ICF walls were subjected to continuous gas flames and temperatures of up to 2000°F for as long as 4 hours. None of the ICF walls ever failed structurally. All of the ICFs tested were of the “flat” or “uninterrupted grid” type, having no significant breaks in the concrete layer. In contrast, wood frame walls typically collapse in an hour or less.

## Do they stop fire from spreading?

Concrete walls have also proven more resistant to allowing fire to pass from one side of the wall to the other. This is especially of interest in areas with brush fires that could spread indoors.

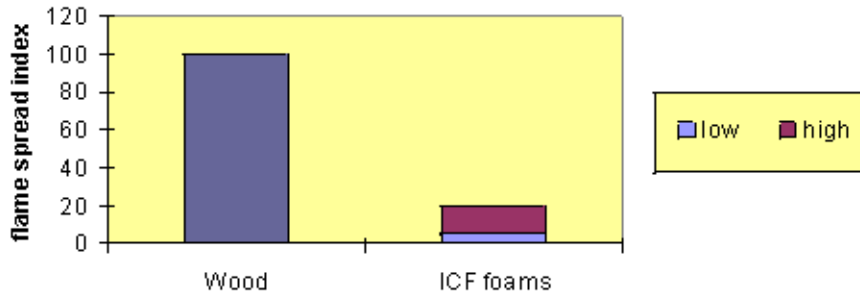
The fire wall test confirms this rule for ICFs once again. Part of the test measured how well the wall slows the passage of heat and fire from the side with the flame to the other side. The ICF walls tested did not allow flames to pass directly through. They also did not allow enough heat through to start a fire on the cool side for 2-4 hours. In contrast, wood frame walls typically allow both flame and fire-starting heat through in an hour or less.

## Will the foam add fuel to the fire?

The foams in ICFs are manufactured with flame-retardant additives. These prevent the foams from burning by themselves. If you hold a match to the material, it will melt away.

Of course, in a house fire, the foam may be subjected to constant flame from other materials burning nearby (wooden floors, fabrics, etc.). The “Steiner Tunnel Test” measures how much a material carries fire from an outside source. In the test, technicians line a tunnel with the material, run a fire at one end, then measure how far the flame spreads. The flames travel about one-fifth as far down a tunnel lined with ICF foams as they spread down a tunnel lined with wood.

## Flame Spread



### Can the foam give off harmful emissions?

Practically any organic material, be it wood or plastic, gives off emissions when it is subjected to intense heat or flame. The Southwest Research Institute reviewed the numerous existing studies of fire emissions and concluded that the emissions from polystyrene foams are "no more toxic" than those of wood.

### What precautions should I take to make my house fire resistant?

No matter what your walls are made of, there is no sense playing with fire. Building codes require covering the inside face of exterior walls with a fire-resistant material, such as gypsum wallboard or a stout plaster.

In areas prone to outdoor fires, it is wise to finish the exterior with a fire-resistant material, too. Favorites are Portland cement stucco and masonry.

And of course the more you can design your home to limit the exposure of flammable materials like wood and fabrics, the better.

### What's the bottom line?

Evidence suggests that ICF walls may be safer in many ways than wood frame in a fire. Using ICF walls in your next home would provide an important and effective measure of fire safety.

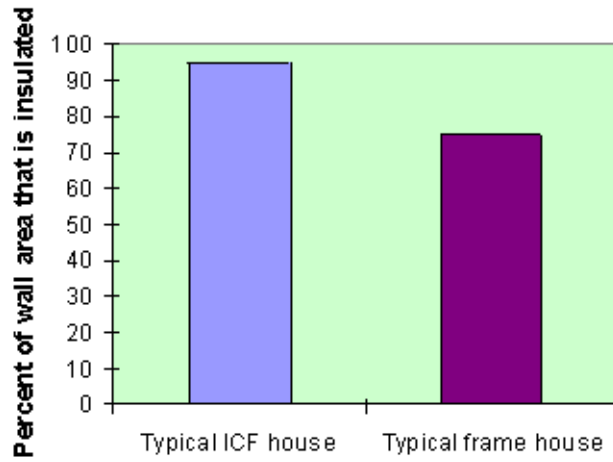
## Comfort and Quiet with Concrete Homes

Concrete walls built with insulating concrete forms effectively buffer a home's interior from the outdoors. The thick ICF sandwich of a massive material (concrete) with a light one (foam) sharply cuts fluctuations in temperature, air infiltration, and noise. They keep the inside of a house more comfortable and quiet than ordinary wood frame walls.

### Where does the greater comfort come from?

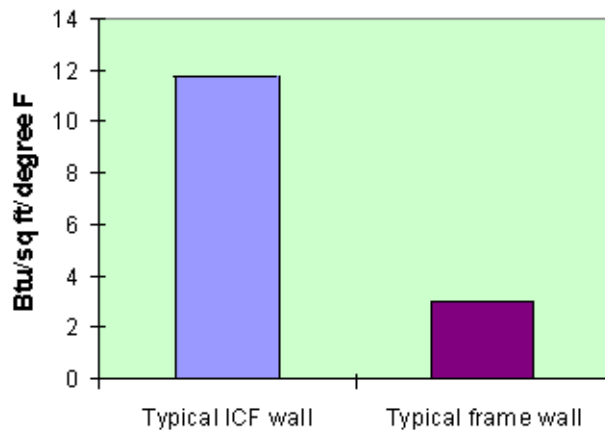
ICF walls increase comfort in three ways:

### Consistency of Insulation



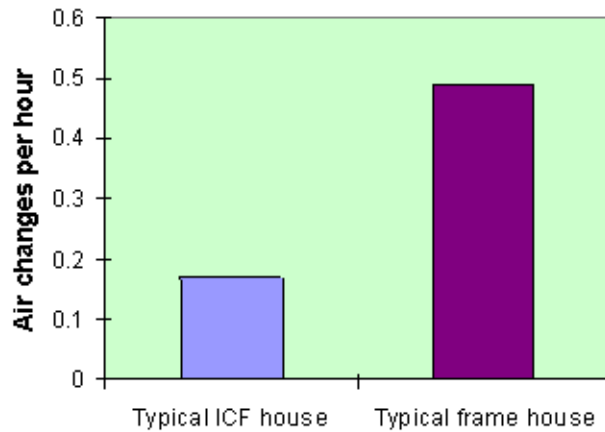
The continuous layer of foam insulation along the ICF wall helps keep the temperature the same everywhere. It virtually eliminates the "cold spots" that can occur in frame walls along the studs or at gaps in the insulation.

### Thermal Mass



The heavy concrete of the ICF wall gives it the heat-absorbing property of "thermal mass". This smoothes out swings in temperature over time. So the house does not tend to overheat or get suddenly chilly as the furnace or air conditioner cycles on and off.

## Air Infiltration

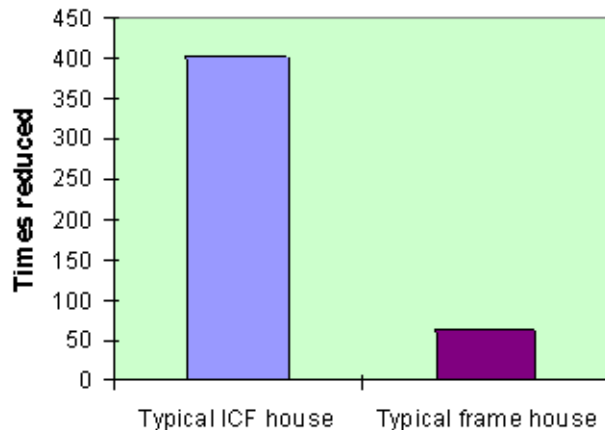


The interlocking foam faces, sealed with continuous concrete in the center, make ICF walls exceptionally airtight. So drafts are cut sharply. In tests, homes built of ICFs had only about one-third to one-half as much air infiltration as the typical frame house.

### What about noise?

Massive materials like concrete tend to reflect noise:

## Sound Reduction

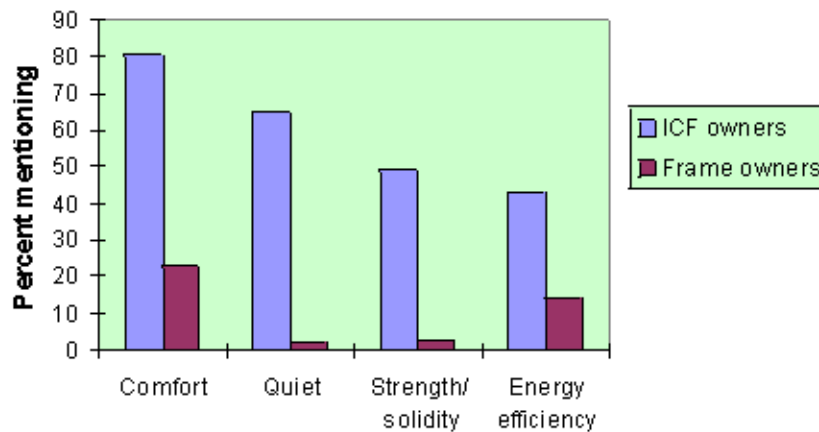


Compared to a typical wood frame wall, only about one-quarter to one-eighth as much sound penetrates through an ICF wall. Scientists would describe loud speech on the opposite side of a frame wall as "audible, but not intelligible." On the opposite side of an ICF wall, a listener would "strain to hear" loud speech. It would be virtually "inaudible."

### But will I really notice the difference?

ICF homeowners appreciate these benefits more than they ever imagined.

## Benefits Homeowners Cite



In a 1997 survey, interviewers asked owners of 74 new ICF homes and 73 new wood frame homes what they liked about them. Over 80 percent of the ICF owners mentioned the great comfort, compared with 22 percent of the wood frame owners. Typical comments were:  
"It's the most comfortable house I've ever lived in."  
"I didn't know what I was missing until we were in it for a while."

Over 60 percent of ICF homeowners mentioned the quietness of their homes, versus only 2 percent of the wood frame homeowners. The ICF owners told two common stories over and over again:

"I looked out the window and saw the traffic on the road, but I couldn't hear it."  
"While talking with my neighbor one morning, he asked if the thunderstorm the night before woke me up, too. But until that moment I never even realized we'd had one."

### What's the bottom line?

When planning a new house, consider the greater well-being that could come from living with a more even temperature, sharply reduced drafts, and noticeably greater quiet. These things are available with concrete walls built with ICFs. They effectively shelter the interior environment from the harshness of the outdoors. ICFs will provide a quiet, comfortable home year round.