

## **Industrial Revolution**

*Every home makes compromises among different and often competing goals: comfort, convenience, durability, energy consumption, maintenance, construction costs, appearance, strength, community acceptance, and resale value. Often consumers and developers making the tradeoffs among these goals do so with incomplete information, increasing the risks and slowing the adoption of innovative products and processes. This slow diffusion negatively affects productivity, quality, performance, and value. This department of Cityscape presents, in graphic form, a few promising technological improvements to the U.S. housing stock. If you have an idea for a future department feature, please send your diagram or photograph, along with a few, well-chosen words, to [dana.b.bres@hud.gov](mailto:dana.b.bres@hud.gov).*

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# **Insulating Concrete Forms: Walls for a Better Home**

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## **Abstract**

*The status quo for a home's walls, both foundation and above-grade walls, has been concrete masonry units (concrete block) or cast-in-place (poured) concrete and wood stud construction, respectively. Insulating concrete forms (ICFs) offer a viable alternative to the status quo. ICFs provide energy efficiency and structural strength advantages over conventional wood or concrete construction.*

## **The Status Quo**

The typical American home with a basement is built on a foundation of concrete block or cast-in-place concrete with the above-grade walls made using wood stud construction. Both foundation construction methods are time consuming. The resulting walls have very low thermal resistance, typically below an insulation value (R-value) of R-2. Although wood stud construction for above-grade walls is relatively quick, the top R-value is only R-19 for a 2- by 6-inch stud wall and less for the more common 2- by 4-inch stud wall.

Some disadvantages of the status quo for wall construction in homes are as follows:

- Energy efficiency, as measured by the R-value, is lower.
- Above-grade walls require significant structural enhancements to become high-wind and seismic resistant.
- Foundation systems are labor intensive and, for cast-in-place concrete walls, require the use of reusable forms.

## Insulating Concrete Forms

Insulating concrete forms (ICFs)—rigid plastic foam forms—hold concrete in place during curing and remain in place afterwards to serve as thermal insulation for concrete walls. Use of the foam sections, which are lightweight, results in energy-efficient, durable construction.

ICFs consist of insulating foam, commonly expanded polystyrene or extruded polystyrene (see exhibit 1). The three basic form types are hollow foam blocks, foam planks held together with plastic ties, and 4- by 8-foot panels with integral foam or plastic ties. ICF forms in general have a vertical, hard plastic strip spaced uniformly in the forms to allow the builder to screw drywall directly to the interior or siding to the exterior. The builder assembles them by stacking the individual forms like Lego® blocks, placing reinforcing steel, and filling the walls with concrete.

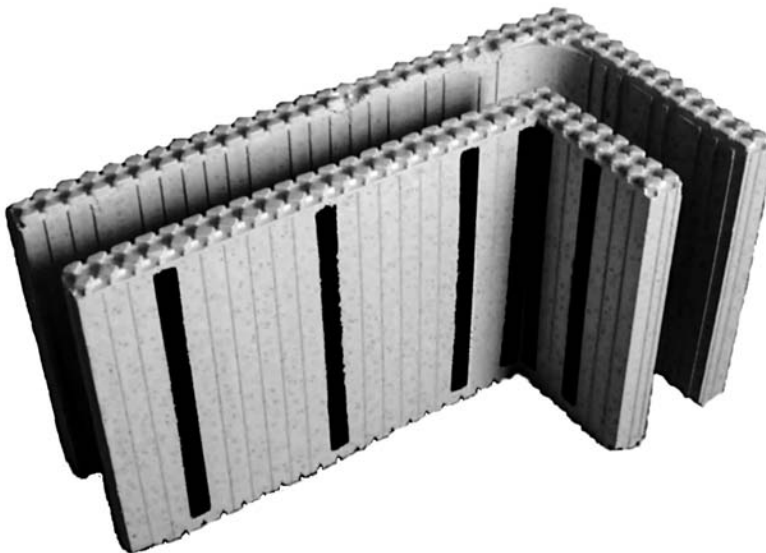
R-values of ICF walls vary depending on the foam material and its thickness. Typical R-values range from R-17 to R-26, compared with between R-13 and R-19 for most wood-framed walls. The strength of ICF structures relative to lumber depends on configuration, thickness, and reinforce-

### Exhibit 1

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Typical Insulating Concrete Form

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ment. In testing to determine impact resistance, the standard 2- by 4-inch “missile” has exploded when it hits an ICF wall. Because ICF walls are designed as reinforced concrete, they have high-wind, seismic, and impact resistance. In a number of cases, cars have struck ICF homes, resulting in little damage to the home and, in some cases, with the homeowner sleeping through the impact.

There are many types of ICF walls. Products are differentiated according to the type of form and the shape of the concrete sections. Products are further differentiated according to how forms attach to each other, how finishes are attached to the wall, R-values, foam types, and other features. Introductory information on the most basic product types follows.

### **Benefits: Foundation Walls**

ICFs can be used for full basements, crawlspaces, or stem walls for slabs.

- Foundation walls built with ICFs may be easier and faster to construct than either block or poured foundations, depending on the area and house configuration.
- With ICFs, forms do not need to be removed as they do with normal cast-in-place concrete using wood or metal forms, eliminating another visit to the site by the installer to remove forms.
- The cost differential may be quite small, especially when finished basements are desired.
- ICF walls are ready for interior finishing, although some products may require furring out first.
- Carpentry crews can be trained to build with ICFs quite easily. Studies show that the learning curve is overcome during the first 3 hours of building with ICFs.
- Total labor plus material costs may be less than when building concrete block foundations.
- Scheduling of trades can be simplified because specialty foundation construction-related trades may not be needed.

### **Benefits: Above-Grade Walls**

ICFs can be used in place of wood framing for most above-grade situations, can be placed on slabs, or can be used for basement or crawlspace walls. Possible benefits of ICFs over wood framing include the following:

- Strength, namely resistance to high winds and to wind-borne debris. Can be designed to resist seismic forces and abnormal loadings.
- Energy efficiency, resulting in greater comfort.
- Thermal mass.
- Solid walls, providing excellent noise abatement.
- Durability.

## **Manufacturers**

A number of manufacturers produce ICFs. The choices of which ICFs to use will be based on local availability, cost, and familiarity with the system by the installers.

## **Sources**

ToolBase TechSpecs: Insulating Concrete Forms (ICF) at <http://www.toolbase.org/Technology-Inventory/walls/Insulating-Concrete-Forms>.

## **Additional Information**

The PATH (Partnership for Advancing Technology in Housing) Technology Inventory on the toolbase.org website provides information on the use and sources of ICFs.

## **Author**

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