INSULATING CONCRETE FORMS FOR MULTIFAMILY RESIDENTIAL CONSTRUCTION

Presented by:

BUILD WITH STRENGTH
A COALITION OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION

Apartment building built using Insulating Concrete Forms (ICFs). Photo courtesy of Nudura®

LEARNING OBJECTIVES

Upon completion of this course the student will be able to:

1. Understand the basic design criteria and construction elements of concrete buildings built with Insulating Concrete Forms (ICFs) for multifamily residential projects.
2. Demonstrate the economic benefits of building multifamily projects with ICFs.
3. Recognize the energy efficiency characteristics of ICF for multifamily construction.
4. Understand the contribution concrete makes to a building's resilience to fire, flood, wind and earthquakes.
5. Identify ways that ICF concrete construction can contribute efficiencies to the on-site construction phase of the project and to long-term efficiencies during the operational phase.

CONTINUING EDUCATION

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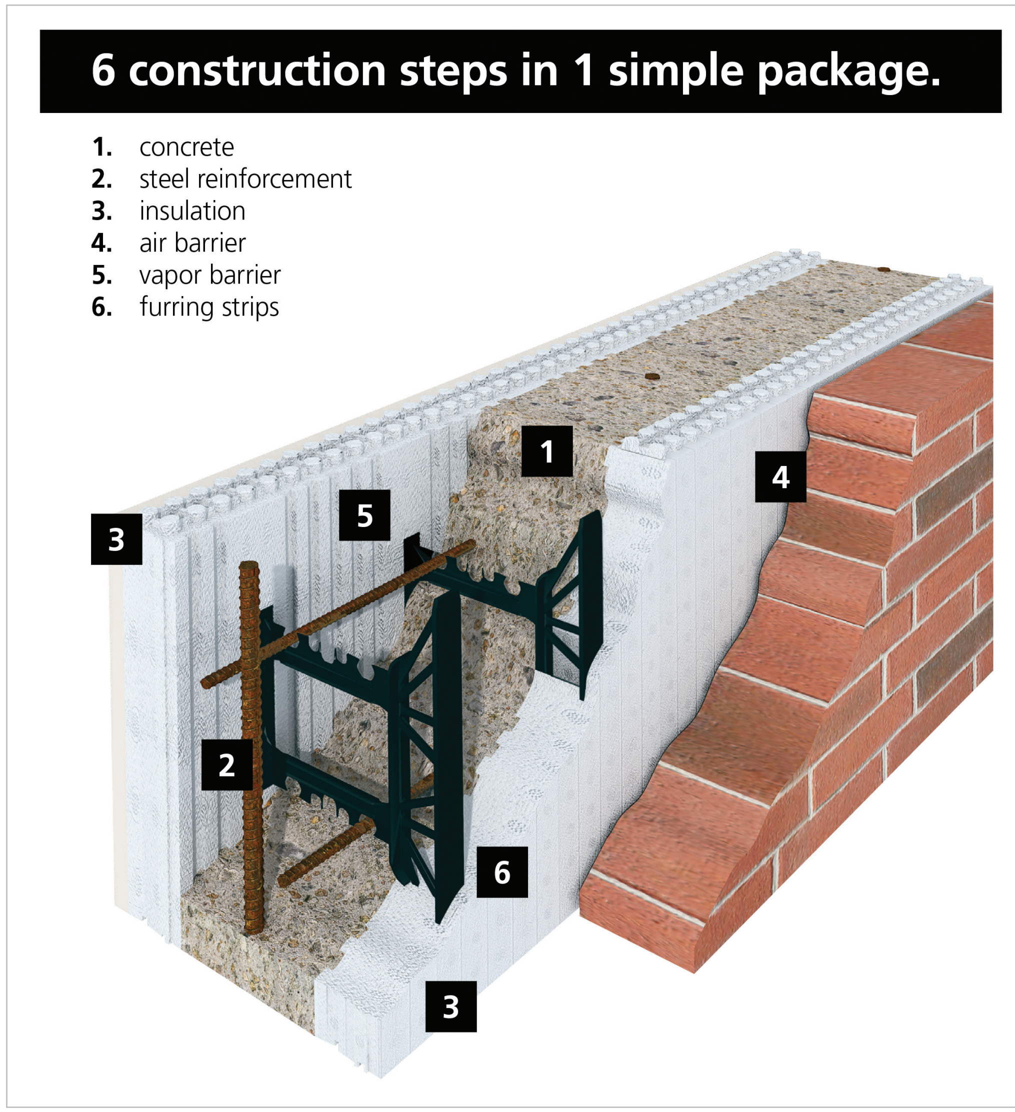
INTRODUCTION TO INSULATING CONCRETE FORMS

Insulating Concrete Forms, or ICFs for short, combine two well-established building products, reinforced concrete for strength and durability, and expanded polystyrene (EPS) insulation for energy efficiency. ICF walls are made up of two layers of rigid insulation held together with ties to form ICF form units with a cavity in the center. The ICF form units are stacked in the shape of the wall, reinforcing steel is added into the form cavity and then concrete is placed into the form. The result is a reinforced concrete wall with a layer of insulation on each side. What makes ICFs different than traditional concrete construction is that the forms remain in place after the concrete is cured to provide thermal insulation. The combination of reinforced concrete and insulation provides an ideal load bearing wall, thermal envelope, fire barrier and sound barrier.

In addition to ICF walls there are also ICF floor and roof systems. The concept is similar in that the ICF form is made with rigid insulation to function as a one-sided form at the bottom surface. The forms are installed to span between concrete walls, reinforcing steel is placed and then concrete is placed over the forms. The result is a reinforced concrete floor or roof with rigid insulation on the bottom.

ICF wall systems have been used for building applications ranging from single story buildings to 20+ story high-rise buildings and everything in between. There are examples of ICF buildings all over the U.S. and Canada including single-family residential, multifamily residential, hotels, dormitories, assisted living facilities, offices, healthcare facilities, manufacturing and warehouse buildings. Schools built with ICFs

Concrete being pumped into an ICF wall. Photo courtesy of Quad-Lock®.



Typical ICF concrete wall components. Image courtesy of Logix®

are popular due to low- or net-zero energy use. Theaters are also trending towards ICF construction for superior sound attenuation. For this article we'll focus on multifamily occupancies including apartments, condos, hotels, dormitories and assisted living facilities.

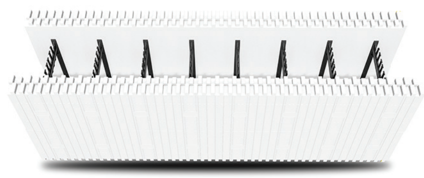
What makes ICFs so attractive for multifamily construction is that they are cost competitive with wood frame, steel frame and masonry construction. A building owner gets a building that is more disaster resilient and energy efficient at or nearly the same cost. Fire safety is a key element of multifamily construction since occupants sleep in these buildings and are often challenged to evacuate during a fire. Concrete walls and floors provide the fire resistance needed to not only allow occupants to evacuate, but contain the fire within a single unit, imposing less risk on fire fighters and property.

ICF Concrete Wall Systems

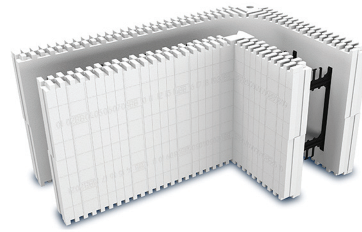
Typically, ICF wall units are comprised of large molded EPS blocks, similar to Lego® blocks. Each individual block is manufactured in an EPS manufacturing facility. The blocks range in size from 48 to 96 inches long and 12 to 24 inches high depending on the manufacturer. The most common configuration of an ICF unit is made up of two layers of 2-1/2 to 2-5/8 inch thick EPS spaced 4, 6, 8, 10 or 12 inches apart depending on design requirements. The most common spacing is 6 inches or 8 inches for most low to mid-rise buildings, but for taller buildings, taller walls, or exceptionally large loadings, thicker walls are necessary. For simplicity, ICFs are generally called out by the width of cavity, hence an ICF with a 6-inch cavity is called a 6-inch ICF and an ICF with an 8-inch cavity is called an 8-inch ICF and so forth.

The blocks are designed to have interlocking teeth that hold the forms together much like Legos®. Most manufacturers not only supply straight blocks but have corner blocks, angled blocks, t-blocks and some even have curved blocks. Most even provide special blocks with brick ledges. Most companies supply blocks that are fully assembled and ready for installation, but some ship blocks that are folded into a flat configuration and then unfolded for installation. One manufacturer ships blocks and ties separately that are assembled on site. Many have special window and door bucks along with other accessories such as bracing, clamps and scaffolding to make the construction process more efficient.

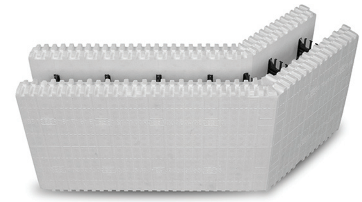
There are some ICF forming systems that are made of other insulating materials and with slightly different configurations and shapes, but flat-wall ICF systems dominate the marketplace. This can be attributed to the fact that flat-wall ICF form units are designed to create standard reinforced concrete structural elements, using well-documented design criteria, such as ACI-318.



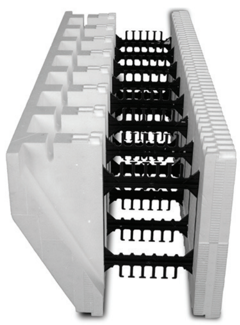
Straight Block



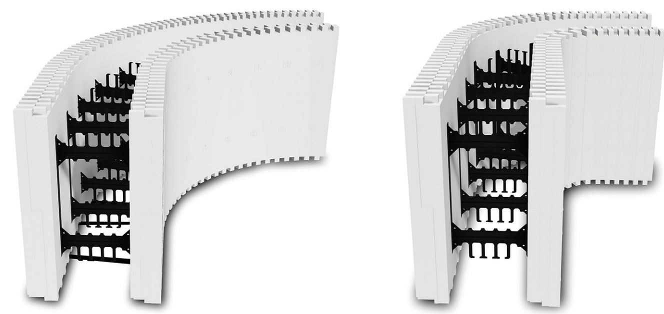
Corner Block



45 Degree Corner



ICF Brick Ledge



ICF Radius Blocks

Examples of ICF wall block configurations. Images courtesy of Buildblock®

There are at least a dozen companies that manufacture flat-wall ICF systems that can deliver their product throughout the U.S. and Canada and many are members of the Insulating Concrete Form Manufacturers Association (ICFMA). For more information visit www.icf-ma.org.

EPS insulation used for ICFs is governed by ASTM C 578, Type II closed cell foam with an R-value of 4 per inch. Polystyrene beads are first expanded with steam forming high density beads, which are injected into a mold to form the desired shape. Once removed from the molds and cured, EPS is a stable and durable material ideal for construction. No chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) or formaldehydes are used in the manufacturing process and there is no off-gassing. EPS is moisture resistant, non-absorbent and resistant to mold and rot. EPS contains a flame retardant and the smoke from burning is non-toxic. In addition, EPS is recyclable at its end of life.

The plastic ties that hold the two wythes of the block together are generally made with polypropylene plastic, but it does depend on the manufacturer. They are designed to withstand the liquid concrete pressure during construction. Most manufacturers design their ties to secure horizontal and vertical reinforcing bars into notches in the ties to minimize the need to use tie wire. Although different manufacturers provide a wide range of spacing for ties, the most common spacing is 6 or 8 inches. The ties have no thermal bridging, they do not degrade or rot over time, and all ties have furring strips embedded in the EPS for screw-on attachment of exterior or interior finishes.

Reinforcing steel used in ICF walls is the same used for any other type of concrete structure. Typically smaller diameter bars are used such as #4, #5 or # 6, but thicker bars can be used for higher loading, concentrated loads and pilasters. In some cases, steel fibers have been used in place of horizontal steel in ICF walls, but most common applications use both horizontal and vertical steel reinforcement.

Concrete is typically placed in ICF walls using a boom-type concrete pump, though line-pumps or even conveyor belt equipment can be used. Specified compressive strength used in ICF walls can be whatever is required to resist structural loading, but most common are a 3000 psi or 4000 psi concrete pump mix. The recommended maximum aggregate size should be 1/2-inch aggregate for 4- and 6-inch cavity forms and 3/4-inch aggregate for 8-inch and larger cavity forms. The required concrete slump is 6 inches but could be up to 8 inches or more to accommodate pumping using high-range plasticizers and mid-range water reducing admixtures to achieve necessary flowability.

As construction continues, electrical and plumbing lines can be embedded into the interior layer of foam by cutting channels with a hot-knife or other tool. Interior or exterior finishes can be applied directly to the surface by screwing into the plastic furring strips. Gypsum wall board on the interior, and stucco, brick or siding on the exterior are common finishes ideally suited to ICF construction but nearly any finish can be applied.

Floor and Roof Systems

There are many options for floor systems that integrate well with ICF wall systems. ICF walls are simply concrete bearing walls so any floor system that is used for other types of bearing wall construction can be used in combination with ICF wall systems. These include traditionally formed reinforced concrete slabs, ICF slabs, precast hollow-core plank, concrete on metal deck combined with steel joists or cold formed joists. Wood framing systems for floor construction can also be adapted for connection to ICF walls using embedded ledger bolts.

ICF Floor and Roof Systems

There are several manufacturers of ICF floor and roof systems that have similar configurations. Just like ICF wall systems, ICF decks combine EPS insulation with reinforced concrete to form a strong and energy efficient floor or roof system. Ideal for use in both commercial and residential construction, ICF floors combine the strength, security, and reliability of reinforced concrete with energy efficiency, fast construction and comfort. Many of the ICF wall system manufacturers carry a version of ICF floor and roof system that interfaces well with their wall system.

Each of the EPS panels (up to about 30 feet long), are supported and reinforced with integral cold formed steel beams or channels molded into the EPS along the length of each panel. The result is a joist and deck forming system that provides the maximum strength of a reinforced concrete deck with minimal materials and labor. The bottom side of each panel is typically flat but the top side has channels along the length of the panel that provide a void for reinforcement and concrete to be placed into. The resultant concrete s ystem is similar to a typical concrete joist system with joists spaced at about 24 inches on center and a slab in between the joists from 2 to 6 inches thick.

The ICF floors and roofs can span up to about 30 feet, depending on the depth of each joist. The joist system is designed like any other concrete joist system with bending reinforcement placed in the bottom of the joists, shear reinforcement placed in the webs and top steel placed for shrinkage and crack control. Although ICF floors are usually designed as simply supported one-way slab systems spanning between ICF walls, they could be designed as multi-span floors with intermediate supports by adding top bending steel.

The EPS material, reinforcing steel and concrete are the same as those used for ICF walls. The bottom surface of the ICF floor or roof is finished with gypsum board by screwing into the embedded metal channels. The top surface is a smooth concrete surface ready for any finish material such as carpet, wood or tile. When used for a roof structure any appropriate roofing system can be used, including membranes, inverted roof insulation, or even vegetated roof assemblies.

Precast Hollow-Core Plank

Another popular floor system, especially for multifamily construction, is precast hollow-core plank. Typically, ICF walls are installed one story at a time (including concrete) and then precast planks are placed on top of the walls, bearing directly on the concrete. Sometimes a concrete topping is placed on the plank or a thin leveling layer is used to even out the floor to accommodate any finish. For some buildings, the ceiling is simply painted or parged with plaster and painted to conceal the joints between planks. There are dozens of hollow-core plank manufacturers around the U.S. and Canada that can supply product for ICF projects and several have developed special details specifically for ICF construction.

QUIZ

1. What materials make up an insulating concrete form wall?
   - a. Structural insulated panels
   - b. Expanded polystyrene
   - c. Reinforced concrete
   - d. Fiberglass insulation
   - e. Both B and C

2. A typical 6-inch insulating concrete form wall easily achieves an STC rating of _____.
   - a. 55
   - b. 75
   - c. 150
   - d. 300

3. True or False: For multifamily construction, ICFs are cost competitive with wood frame, steel frame and masonry construction.

4. True or False: EPS used for ICFs is typically ASTM C 578, Type II closed cell foam with an R-value of 4 per inch.

5. True or False: Any floor system that is used for other types of bearing wall construction can be used in combination with ICF wall systems.

6. ICF floors and roofs can span up to about ________, depending on the depth of each joist.
   - a. 10 feet
   - b. 16 feet
   - c. 20 feet
   - d. 30 feet

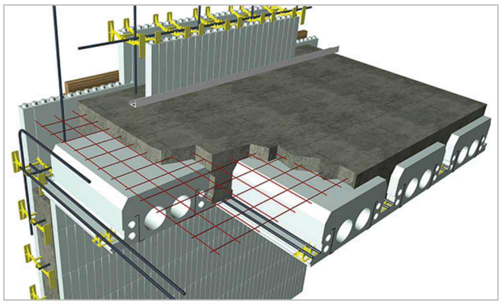
7. Which systems offer the advantage of having space for mechanical and electrical within the ceiling cavity?
   - a. Precast hollow-core plank
   - b. Concrete on metal deck combined with steel joists or cold formed joists

8. True or False: ICFs are best suited for floor-to-ceiling curtain wall type construction.

9. Which of the following performance benefits do ICFs have?
   - a. Noise attenuation
   - b. Fire resistance
   - c. Energy efficiency
   - d. Strength
   - e. Durability
   - f. All of the above

10. ICFs are considered by the IECC and ASHRAE 90.1 as mass walls with continuous insulation and typical whole wall ICF assemblies have an R-value between _________ depending on the exterior and interior finish materials.
    - a. R-11 and R-19
    - b. R-20 and R-23
    - c. R-24 and R-26

This article continues on http://go.hw.net/AR217Course1. Go online to read the rest of the article and complete the corresponding quiz for credit.



Typical ICF wall to floor/roof connection detail. Image courtesy of Quad-Lock®

Concrete on Metal Deck, Steel Joists and Cold Formed Joists

Concrete on metal deck combined with steel joists or cold formed joists are another option for ICF wall systems. There are numerous steel joist and cold formed joist manufacturers that have designed systems specifically to integrate with ICF walls. Some provide a steel bar joist system with concrete on metal deck along with other concrete deck systems. Others make a cold formed joist and concrete deck system for ICF walls. These systems offer the advantage of having space for mechanical and electrical within the ceiling cavity. For multifamily residential the mechanical and electrical are often limited to the kitchen and bath areas so having space in the ceiling cavity is not as critical. For other occupancy types however, having open ceiling space may be a distinct advantage.

PERFORMANCE CHARACTERISTICS OF ICF CONCRETE (CODES AND COMPLIANCE)

ICF walls are best suited for bearing wall type construction. If the architectural style for the building is to have floor-to-ceiling glass with large cantilevered balconies, then traditional concrete flat-plate construction is the best option. However if the building is a typical apartment building, hotel, dormitory or assisted living facility with a significant solid exterior wall with punched window openings, then ICFs are the ideal solution. Generally these types of buildings have a rectangular floor plate with the elevator in the center. Longitudinal corridors service living units on either side. Each unit has a solid wall on the exterior and at the corridor making them ideal to function as structural bearing walls.

Furthermore, since multifamily construction requires fire barriers between dwelling units, ICF walls create a superb demising wall. Besides providing superior protection from spreading fire (2 to 4 hours), ICFs also have excellent noise attenuation properties. Whether designing an apartment complex or hotel, fire safety and noise reduction are always a concern. Energy efficiency is also a major concern for apartment owners and hotel operators. ICF concrete buildings benefit from the lower energy bills resulting from the high-performance envelope.

Strength and Durability

The heart of ICF construction is reinforced concrete. Reinforced concrete walls and floors have long been the building material of choice for resisting structural loading from wind, earthquakes, flooding and fire. There are many examples of concrete buildings surviving natural disasters while surrounding buildings built with less durable materials simply don't have the strength and durability to resist the loading. Concrete walls and floors are designed using traditional requirements of the ACI 318 Building Code Requirements for Structural Concrete. The same analysis and design techniques used on traditionally formed concrete buildings are used on ICF buildings. What makes ICF structures even stronger and more durable is the fact that the walls and floors are tied together with overlapping reinforcing steel creating a monolithic structure.

These types of structures are extremely resistant to high loading and provide significant redundancy which avoids catastrophic failure. The solid walls act as shear walls to resist wind and earthquake loading. They also provide protection from flying debris from hurricanes and tornadoes. Because concrete and EPS are water resistant, even when a building is subject to flooding, the structure survives. This property protection is vital for communities to withstand and recover from disruptive events.

Fire Resistance

The U.S. Fire Administration reports that fire kills more Americans than all natural disasters combined. In 2015, there were 1,345,500 fires reported in the United States. According to the National Fire Protection Agency, these fires caused 3,280 civilian deaths, 15,700 civilian injuries, and $14.3 billion in property damage. Of all the construction materials used today, concrete is the most fire resistant. This gives the noncombustible concrete structure important safety advantages over traditional combustible wood frame structures. Unlike wood, concrete cannot burn; and unlike steel, it won't soften or bend. Concrete will only break down at temperatures of thousands of

All the buildings in this photo are built using ICFs. Photo courtesy of Fox Blocks®

degrees Fahrenheit, which is far hotter than the temperature of a typical structure fire.

Fire safety is important for any building occupancy, but it's especially critical for residential type construction where people sleep. Concrete has long been recognized as the most fire resistant of all building materials and there are decades of testing available to demonstrate this. However, as with all building assemblies, they must be tested using standard fire tests to demonstrate their fire resistant capabilities.

Most ICF manufacturers have tested their products in accordance with standard fire testing protocol including ANSI/UL 263 and ASTM E119. In general, 4-inch ICF walls achieve a 2-hour fire rating, 6-inch ICF walls achieve a 3- or 4-hour fire rating and 8-inch and thicker ICF walls exceed a 4-hour fire rating. Generally the assemblies tested include reinforced concrete with a minimum compressive strength of 2,900 psi and 1/2-inch gypsum wall board on each side.

In addition to fire resistance rating of wall assemblies, it is important to understand the behavior of the EPS under fire conditions. The EPS used for ICFs is manufactured with flame retardants that render the EPS insulation completely unable to support a flame without an outside flame source; it is approximately five times better than wood at stopping flame spread from materials burning in close proximity. That means an extra margin of safety for occupants and first responders. EPS used for ICFs is strictly required to have a flame spread index of less than 25 and smoke developed rating of less than 450 when tested in accordance with ASTM E84 & ANSI/UL 723. ICF companies that maintain national evaluation reports from ICC-ES or other accredited testing agencies have all conducted a long list of materials tests in order to comply with national safety standards.

CASE STUDY: HILTON GARDEN INN, LEWISVILLE, TX

Hilton Garden Inn and Convention Center, Lewisville, TX. Photo courtesy of Nudura®

With the objective of keeping their guests safe, secure and comfortable, Hilton Garden Inn in Lewisville, TX chose ICF construction for their six-story hotel and 25,000 square foot convention center. Eight-inch ICF walls were used on the first two levels and 6-inch ICF walls were used for the top four levels. Precast hollow core concrete planks were used for the floors. The result is a fire resistant concrete building with the added benefits of energy efficiency, durability, and peace and quiet.

Energy Efficiency

According to a new report from the Institute for Market Transformation (IMT), increasing the energy efficiency of America's multifamily buildings—nearly 18.5 million households—could save building owners and managers, residents, governments, energy efficiency service providers, and financiers close to $3.4 billion annually. With these growing energy concerns, building with ICFs is simply the smart choice. The secret lies in the combination of reduced conduction and convection, and high thermal mass. The result is a building with a lower appetite for energy and vastly improved comfort inside the building due to more consistent temperatures and lack of drafts. A more energy efficient envelope means more money saved on a yearly basis while reducing the project's carbon footprint.

ICF walls are considered by the IECC and ASHRAE 90.1 as mass walls with continuous insulation. Typical whole wall ICF assemblies have an R-value between R-24 and R-26 depending on the exterior and interior finish materials compared to R-11 and R-19 for 2x4 and 2x6 wood frame. Thermal resistance (R-value) does not take into account the effects of thermal mass, and by itself does not fully describe the beneficial properties of ICFs. The damping and lag effect of thermal mass means fewer spikes in heating and cooling requirements since the mass buffers indoor temperature fluctuations, contributing to occupant comfort. Thermal mass shifts energy demand to off-peak time periods when utility rates are lower, reducing costs further. ICF walls can exceed the requirements for all climates zones for both residential and commercial thermal envelopes above and below grade because of the combination of extreme R-value and thermal mass.

Achieving a high performance building envelope also means minimizing air leakage and ICF walls are tighter than wood-frame or light gauge steel walls. In tests, they averaged about half as much air infiltration as wood frame. In many cases the air infiltration rates are as low as 0.5 air changes per hour. Thermal bridging is also eliminated with ICF walls when compared to wood and light gauge steel. Since energy consumption of ICF buildings are lower, the HVAC systems can be smaller and more efficient, adding to energy savings. The result is energy savings ranging from 20 percent to as much as 50 percent depending on other energy efficiency strategies employed for the building.

CASE STUDY: WEST VILLAGE STUDENT CONDOMINIUM, HAMILTON, ONTARIO

West Village Student Condominium, Hamilton, Ontario. Photo courtesy of Nudura®

West Village Student Condominiums, located near McMaster University in Hamilton, Ontario, operates for less than half the cost of typical buildings of this type thanks to ICF construction. The two 9-story, 208,000 square foot buildings house 450 students in 107 suites. Combining ICF walls with a large evacuated-tube solar system significantly reduces energy demand and helped the project achieve LEED Platinum status. The Platinum certification was due in part to energy savings of 57 percent which means the owner spends about $1,000 annually per apartment, less than half what a typical apartment building costs to operate. In addition to thousands of dollars saved in energy costs each year, significant cost savings were achieved during construction by downsizing the heating and cooling systems. Additional savings were realized due to reduced construction time of ICFs—the buildings were completed in 10 months.

Noise and Vibration

Concrete walls and floors have long been used as the material of choice for reducing sound transmission, which is key to a better guest experience in the hospitality sector.
ICFs are often used for hotel and hospitality projects for their ability to isolate and dissipate noise. Noise transmission in residential buildings is also important both to reduce noise between units and from the outside. Most multifamily buildings, whether they are apartment buildings or hotels, are generally located in urban centers where car and truck traffic can affect occupants' quality of life. And no one wants to live in an apartment building where you can hear the neighbors. The fact that ICFs can eliminate sound transmission at virtually no additional cost makes them very attractive for any project in which peace and quiet is a selling point.

The concrete core of ICF offers excellent noise control in two ways. First, it effectively blocks airborne sound transmission over a wide range of frequencies. Second, concrete effectively absorbs noise, thereby diminishing noise intensity. Because of these attributes, ICF walls and floors have been used successfully in multifamily and hospitality applications.

The International Building Code (IBC) has requirements to regulate sound transmission through interior partitions separating adjacent dwelling units and separating dwelling units from adjacent public areas. Six-inch ICF walls easily achieve STC 55 (Sound Transmission Classification) rating. Higher STC ratings up to STC 70 can be achieved with additional gypsum wallboard or special isolation channels. For ICF floors, most meet STC 50 or higher and IIC (Impact Insulation Class) of 50 or higher depending on the floor and ceiling finish as required by the IBC.

CASE STUDY: THE RICCHI, SAN ANTONIO, TX

The Ricchi Condominiums, San Antonio, TX. Photo courtesy of Ricchi Group

The Ricchi condominiums in San Antonio are a contemporary, mid-rise building consisting of 87 luxury condominiums. This exclusive development was the first of its kind to be built in the area. The developers wanted to provide a first-class, secure and quiet building and chose ICF as part of the plan to achieve their goal. Noise reduction was a major consideration for this project. The Ricchi is located directly below the flight path for airliners approaching San Antonio's international airport and is adjacent to a US Army training camp. The sound attenuation offered by ICFs provided a solution to those concerns while creating significant energy savings. The U-shaped, luxury condo utilized more than a quarter million square feet of ICFs. The higher insulation provided by the ICF walls reduced HVAC tonnage by 20 percent, resulting in significant energy savings.

Initial Cost and Long Term Value

ICF construction can help contain construction costs because of the inherent efficiencies of the installed assembly that serves nine functions:

1. Concrete form (that stays in place)
2. Thermal barrier
3. Air barrier
4. Moisture barrier
5. Fire barrier
6. Sound barrier
7. Substrate for running utilities
8. Substrate for attaching finish materials
9. Reinforced concrete structure

In conventional construction, many of these features are provided by several different trades, usually at significant added cost. ICF construction embodies all of these characteristics in a simple assembly usually installed by one crew. This means general contractors can realize a number of on-site efficiencies including fewer trades on-site, reduced crew-size and an accelerated construction schedule. Because construction schedules are usually much shorter with ICF construction, the general contractor is able to finish on-time and within budget. The building owner is able to put the building into service sooner, cutting short his financing costs and initiating a quicker revenue flow.

In general, ICF construction costs can be equal or slightly higher than wood or steel frame construction. Building with large ICF units instead of individual small framing elements such as dimensioned lumber or cold formed steel can save on initial cost. In addition, the lower floor-to-floor heights of ICF walls and concrete floors (precast plank or ICF) can help reduce the overall height of a building which means additional savings from reduced exterior and interior finishes and reduced mechanical, electrical and plumbing lines, which can be significant.

In one research study, the cost of building a four story, 100,000 square foot apartment building built using wood, masonry, precast and ICF were compared for cities all over the U.S. In most cases the cost of ICF construction was about 5 percent more than wood frame. But it did depend on location. For example, the cost of ICF ranged from 4 percent less to 3 percent more than wood frame in Houston, but ranged from 6 percent more to 11 percent more in Los Angeles.

Another way developers can save on initial cost is by lowering construction insurance premiums. In a recent study one insurance underwriter estimated that builder's risk insurance for wood structures would cost an estimated $.05 per $100 of construction per month during the construction. For concrete structures, this cost would be $.005 per $100 of construction per month. Based on these rates, for a $10 million building that takes 12 months to construct, the wood frame builder's construction insurance would be $60,000 compared to $6,000 for the concrete builder.

But the real savings and value of ICF construction comes over the long term from reduced energy bills and lower maintenance. These savings not only reduce operating cost, they reduce risk, which translates into lower property insurance rates and lower tenant turnover and disruption. For those developers who plan on holding onto properties for longer periods of time or looking for long term rental, it's critical to have a building that has a lower operating cost and holds value.

CASE STUDY: LANE 1919 APARTMENTS, PORTLAND, OR

Lane 1919 Apartments, Portland, OR. Photo courtesy of Opsis Architecture

A focus on quality, reduced life-cycle costs, and the creation of value for the next 80 years drove the Lane family along with the rest of their investment and design team to create a mixed used project that paid tribute to the historic significance of the neighborhood while combining modern innovative design and construction methods. The project team's goals were not only to create a viable income-producing property for the Lane family, but also to incorporate energy efficiency and extended life-cycle equipment and materials. The Lane 1919 mixed-use tower is built from highly-efficient ICF walls that provide greater thermal mass, high R-value and reduced air infiltration offering the building owner significantly reduced energy bills.

CONCLUSION

ICFs represent an advancing technology. Although there are thousands of examples of ICF buildings all over the U.S., Canada and other parts of the world, many designers are not fully familiar with the construction method. ICFs can add value to any construction project, but the added fire safety, energy efficiency and noise reduction qualities make them ideal for multifamily construction. The most common ICF brands have similar dimensions and thus architects can design a building with ICFs without having to design it to a specific manufacturer's specifications. Most of the larger ICF companies have standard specifications, design details and design manuals to help architects and engineers with the design process.

The largest ICF manufacturers have all the necessary qualifications to meet the latest building code requirements including fire, energy, sound transmission and structural design. In addition, because ICFs saves so much energy over time, they can help meet LEED and other green building standards. Although ICFs are unique in the sense that the insulation is installed before the structure is installed, in the end the design details are the same as if you installed concrete bearing walls and then attached rigid insulation to the wall.

The key benefits of ICF construction are:

- Strength and durability
- Fire safety
- Energy efficiency
- Sustainability
- Noise reduction
- Long term value

The best place to find out about ICF construction and concrete construction in general is www.BuildwithStrength.com and www.icf-ma.org. ■