Southwest
New Brunswick
Service Commission

ICF information

Insulated Concrete Forms have been around for a while, and have gained popularity for a number of reasons. They're easy to assemble, offer long-term insulation value, provide considerable strength and resilience and allow construction of above-ground concrete without the need to have an engineered plan.

Here's some of the things a potential builder/owner may want to know about ICF construction from the ground up.

Foundations

If ICF is only going to be used for a frost wall, then there's little difference between the footings for a standard frost wall and an ICF. However, footing width has to be increased by 15 cm (6") for every above-ground storey of ICF planned. See more on foundations, here. One critical requirement of a foundation for an ICF wall is that it needs to be wider by code as noted, but the footing must also be as deep as the wall being supported

ICF on rock

There is a considerable upside to ICF foundation walls when constructing frost walls on solid rock. It is possible to ignore footing requirements in such situation, in other words, put the frost wall directly onto the rock. With some simple tools and a bit of patience, the foam ICF blocks can be hand-shaped to fit the contours of the stone – a far easier process than trying to create forms otherwise.

Protection of below-ground ICF

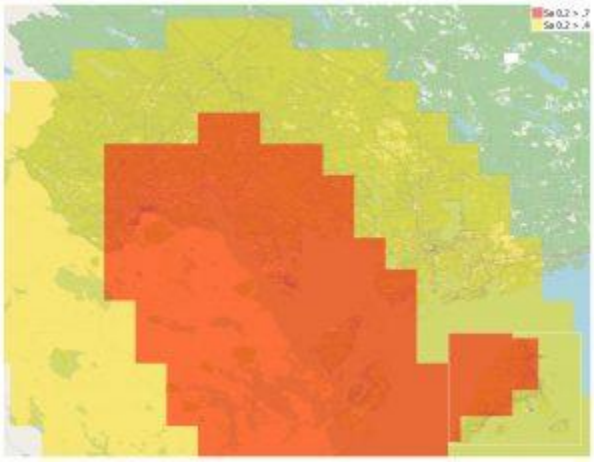
Just as with normal concrete walls, the exterior of below-grade ICF walls must be protected from water intrusion. This must be done with application of an adhesive-backed material that usually comes in rolls. Generally speaking, ICF form manufacturers will supply a brand-specific product for application on-site. (Exception: if there is no living space below grade and the ICF is just being used as a foundation for a slab-on-grade style construction, drainage and protection requirements may not apply.)

Reinforcement of ICF

The upside to ICF construction is that it allows for (in some cases) thinner concrete walls than the traditional 20 cm (8") variety; the downside is that there are Code-required reinforcements that must be adhered to. ***As a result, all ICF reinforcement must be inspected prior to the pouring of concrete*** to ensure sufficient reinforcement is placed.

The required reinforcements depend heavily on three factors: the width of the ICF form, the height above ground, and openings within the walls

Earthquake issues



Any above-ground ICF construction in this yellow or red area must be engineered to resist earthquake forces.

Throughout much of our region - see the yellow area in the map shown here - above-ground ICF installations require an engineered design. All commercial buildings require an engineered design, from an engineer licenced to work in this province. Some manufacturers can provide engineered designs for modest residential structures (See table below).

Wall openings:

The National Building Code's general guidelines for small buildings - Part 9 of the code - limits openings in ICF assemblies to 1.2 metres of a corner. If your plan requires an opening closer to that, it will have to have an engineered design. However, a number of manufacturers have provided a general engineered design to allow openings closer than 1.2 metres in ICF construction.

Recently, a group of six ICF manufacturers worked together to create an engineered design manual that will cover a significant number of residential builds, and takes into account the above-mentioned restrictions. We also have documentation from Trufoam, to assist with wall opening limits.

Legend:

ENG: requires engineered design
ALT: Can be built to an engineered design on file at our office
NBC: Can be built to National Building Code standards

The item before the dash is for the general construction; the item after the dash refers to requirements for openings less than 1.2 m from a corner. (Note that any structure 600m2 or greater will require engineered design throughout.)

ICF manufacturer	Charlotte County - building type		
	Commercial	Residential <300m2 (3,230 ft2)	Residential > 300m2
Quadlock	ENG-ENG	ALT-ALT	ENG-ENG
Superfoam	ENG-ENG	ALT-ALT	ENG-ENG
Foxblocks	ENG-ENG	ALT-ALT	ENG-ENG
Buildblock	ENG-ENG	ALT-ALT	ENG-ENG
Nudura	ENG-ENG	ALT-ALT	ENG-ENG
Amvic	ENG-ENG	ALT-ALT	ENG-ENG
Logix	ENG-ENG	ALT-ALT	ENG-ENG
Trufoam	ENG-ENG	ENG-ENG	ENG-ENG
Other	ENG-ENG	ENG-ENG	ENG-ENG

ICF manufacturer	York County, building type		
	Commercial	Residential <300m2	Residential > 300m2
Quadlock	ENG-ENG	NBC - ALT	NBC - ALT
Superfoam	ENG-ENG	NBC - ALT	NBC - ALT
Foxblocks	ENG-ENG	NBC - ALT	NBC - ALT
Buildblock	ENG-ENG	NBC - ALT	NBC - ALT
Amvic	ENG-ENG	NBC - ALT	NBC - ALT
Nudura	ENG-ENG	NBC - ALT	NBC - ALT
Logix	ENG-ENG	NBC - ALT	NBC - ALT
Trufoam	ENG-ENG	NBC - ALT	NBC- ENG

The tables below are for construction that can be covered by the National Building Code tables - if you're uncertain, call our office.

Horizontal, foundation wall

a) one 1.13 cm (1/2", 10M or #4) bar placed within the first 30cm (12") of the top of the wall
b) 1.13 cm (1/2") bars placed horizontally no further than 60 cm (24") apart
b) These bars must be located on the inside half of the wall section but no closer than 3 cm (1 3/16") from the inside face. [9.15.4.5.1]

This image shows the placement of horizontal rebar. Horizontal reinforcing bars must be located within the inside half of a wall, but no closer than 3cm from the edge, to allow for full coverage by concrete.

Vertical reinforcement, foundation wall

The required vertical reinforcement depends on the width of the ICF form being used. If the form width is not listed in the NBC, it shall be reinforced in the same manner as a form of the nearest smaller listed width. Where interrupted by openings, vertical rebar shall be placed at no more than 60 cm from the edge of those openings. Rebar above and below the openings must conform to the listed separations. Note that a 15m mm bar is 1.6 cm (a #5, or 5/8" imperial measurement.)

Table 9.15.4.5.A.
Vertical Reinforcement for 140 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
1.35	10M at 400 mm o.c.	10M at 400 mm o.c.	10M at 400 mm o.c.
1.6	10M at 400 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2	10M at 380 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2.2	10M at 250 mm o.c.	10M at 250 mm o.c.	10M at 250 mm o.c.
2.35	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
2.6	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
3	n/a	n/a	15M at 250 mm o.c.

Table 9.15.4.5.B.
Vertical Reinforcement for 190 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
2.2	None required	10M at 400 mm o.c.	10M at 400 mm o.c.
2.35	n/a	10M at 300 mm o.c.	10M at 300 mm o.c.
2.6	n/a	10M at 300 mm o.c.	15M at 400 mm o.c.
3.0	n/a	n/a	15M at 400 mm o.c.

Table 9.15.4.5.C.
Vertical Reinforcement for 240 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
2.2	None required	None required	None required
2.6	n/a	15M at 400 mm o.c.	15M at 400 mm o.c.
3.0	n/a	n/a	15M at 400 mm o.c.

Horizontal, above ground

a) one 1.13 cm (1/2") bar placed within the first 30cm (12") of the top of the wall
b) 1.13 cm (1/2") bars placed horizontally no further than 60 cm (24") apart
These bars must be located on the inside half of the wall section.

Vertical, above ground

Vertical reinforcement shall be comprised of 1.13 cm (1/2") bars, spaced no more than 40 cm (15 3/4") on centre apart. These bars must be placed in the middle third of the wall section. Reinforcements interrupted by openings shall be placed no more than 60 cm (2') from each side of the opening.

Overlapping requirements

Unless otherwise specified - that is, by an engineer or the manufacturer - then 1.13 cm rebar must be overlapped by 45 cm (17 3/4") and 1.6 cm rebar overlapped by 25 9/16".

Openings (doors/windows) in ICF walls

There are a number of restrictions to openings in ICF walls. The restrictions are dependent on whether the wall is load-bearing or not.

Non-loadbearing

Openings in ICF walls cannot be closer than 1.2 metres (4') from a corner.
Concrete must be 20 cm (7 7/8") deep above any opening.
Openings more than 60 cm but less than 3 m (2' to 9'10'') must be reinforced at the top and bottom with a length of 1.13cm (1/2") rebar that extends 60 cm (2') beyond the opening, on both sides
Openings more than 3m (9'10") shall be reinforced on all four sides with two 1.13 cm (1/2") bars.

Openings cannot comprise more than 70 per cent of any non-loadbearing ICF wall.)[9.10.1.3]

Loadbearing

Openings in loadbearing walls present an interesting twist. If the opening is more than 1.2 metres (four feet), then the opening must be reinforced with 1.13 cm (1/2") rebar running horizontally, and a second layer of rebar running below that, held in place by stirrups. (These are sections of rebar bent into an extended "C" or "S" shape.) The spacing of the stirrups must be no more than half the distance from the bottom reinforcing bar to the top of the lintel. In many cases, ICF form manufacturers will stipulate a different spacing that can over-rule Code-requirements. (This construction is detailed, and not recommended for one without significant experience in the field. If nothing else, the creation of stirrups requires specialized tools the average lay person or even seasoned stick-frame builder will likely not have.)
Again, openings cannot be closer to the corner than 1.2 metres, unless engineered to be so.

Attaching joists

The attachment of joists in multi-storey ICF construction is usually done by inserting bolts into the forms prior to the concrete pour, then affixing a ledger board to the bolts. (In most cases, contractors will install the bolts to the board and attach the board prior to the pour: this is much easier than attempting to drill holes and attaching the ledger board after the fact.)
The following table outlines the required size and spacing of bolts.

Table 9.20.17.5.
Maximum Anchor Bolt Spacing for the Connection of Floor Ledgers to Flat Insulating Concrete Form Walls
Forming Part of Sentence 9.20.17.5.(3)

Maximum Clear Floor Span, m	Maximum Anchor Bolt Spacing, mm	
	Staggered 12.7 mm Diameter Anchor Bolts	Staggered 16 mm Diameter Anchor Bolts
2.44	450	500
3.0	400	450
4.0	300	400
5.0	275	325

The joists must be attached using joist hangers: no other method of attaching joists to a ledger board is acceptable. [9.20.17.5(1)]